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DEVELOPMENT AND VALIDATION OF SHIPBOARD NOISE EXPOSURE DATA ACQUISITION PROCEDURES

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EXECUTIVE SUMMARY

This study is concerned with the development and validation of a shipboard noise exposure data acquisition procedure. This procedure represents a first step in the overall framework for a Navy Noise Exposure Data Management System, which is discussed in the text. The immediate purpose of this data collection process is to provide for standardized measurement techniques that may be used by various Navy units concerned with occupational noise and hearing conservation. This noise data base, when computerized, can be used in concert with the shipboard noise exposure model developed in an earlier study [1] to assess the magnitude of the overexposure problem on individual ships, ship classes and ultimately the entire fleet. The benefits of this approach are guidance in the development of hearing conservation and educational programs, and in the assessment of noise control priorities in the fleet. Future extensions of the data management system include:

1. The assessment of audiometric data together with the noise exposure data as a function of personnel rates and,

2. Extension of the system capabilities to other occupational hazards such as heat stress.

The results of this study, which was conducted on 12 ships of the FF-1052 (Knox) Class, showed that standardized measurement techniques consistent with the requirements of the data base can be successfully collected by Navy personnel (Environmental Preventative Medical Units). Both the time required to perform each survey and the quality of the data collected by the EPMUs meet with the original goals of the study.

The validation of the data base was conducted based on the analysis of the "auxiliary steaming" operational mode of 12 ships. Noise exposures for various engineering rates were computed using the analytic model and compared with an independent data set collected using dosimetry. The results of direct comparisons show substantial discrepancies. These are due mostly to a lack of consistent definition in the personnel assignment data and the proximity of the calculated noise exposures to the threshold established by the BUMED noise standard. In retrospect, the selection of the "auxiliary steaming" operational mode was unfortunate in the validation effort. It is believed that comparisons for an "underway" operational mode would yield significantly more consistent results.

It is recommended that a limited validation of the "underway" mode be conducted. Furthermore, it is recommended that the data base be computerized, at least for the FF-1052 (Knox) Class and that all EPMUs utilize the data acquisition procedures when surveying this class.

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1.0 INTRODUCTION

The research reported here has been supported under the Office of Naval Research Contract N0014-78-C-0408 with funds provided by the Naval Medical Research Development Command.

1.1 Historical Review

The U.S. Navy has been concerned for many years with the noise environment to which its personnel are exposed on-board ships and at Navy ground installations. To that effect, various shipboard noise standards, like the BUMED INST 6260.6 series, and more recently, the DOD INST. 6055.3 have been promulgated. The U.S. Navy Medical Department also performs audiometric examinations on personnel entering the Navy and then at subsequent stages of their duty. The objectives of the noise standard and the hearing examinations are the prevention and early identification of occupationally induced hearing loss.

Measurements conducted on-board ships, and especially in engineering spaces, indicate that the high noise levels present may potentially result in substantial hearing loss and subsequent compensation. Although a significant effort has been expended over the last several years by the Navy to measure and control shipboard generated noise, no personnel noise exposure data collection and evaluation system is currently available. Noise exposure data are rarely computed since this involves a relatively complex process, especially in shipboard environments. The complexities are due to the varied operational characteristics of ships (and thus of the machinery responsible for the noise) and the difference in personnel work assignments for different ship operational modes.

Furthermore, audiometric data are normally restricted to the individual's medical record and no data concerning correlation between high noise exposure occupations and hearing loss trends are available.

1.2 Program Objectives

The need for a noise data base system clearly exists. The method of solution suggested here is the development of a shipboard noise exposure data management system that may be used by the Navy, at all levels of enforcement and hearing conservation planning, to monitor and quantify the noise exposure problem in the fleet.

A model that could serve as the central core for such a system has been previously developed under sponsorship of NAVMAT [1]*. The objective of this first phase of the work reported herein is to develop and validate the data acquisition system to the model. Specifically, the main objectives of the program are:

1. To evaluate the Navy procedures and capabilities in the area of noise data collection,

2. To develop the methodology for the data acquisition system based on the Navy capabilities, and,

3. To validate the accuracy of the data acquisition system and the noise exposure model.

It should be noted that although the major emphasis of the proposed work is the description of the hearing loss hazard -- noise -- other occupational health hazards such as heat stress may also be approached in a similar manner.

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* The subject of occupational noise aboard ships has been addressed to some extent in a recently completed study entitled, "Occupational Noise Exposure on FF 1052 (Knox) and DD 963 (Spruance) Class Ships." This report which concerns itself only with the noise exposure in engineering spaces, points out the deficiencies of the present data acquisition system, and suggests a method for solution.

Numbers in [] concern references listed at the end of this report.

1.3 Program Constraints

The pursuit of the above objectives was conducted under the following constraints:

1. The data acquisition procedures were designed around acoustic equipment currently available in the Navy.

2. The data acquisition supportive of this program was performed by the Navy Environmental Preventative Medicare Units EPMU in the course of their normal duties. To limit the time necessary for the surveys, only the In-Port operational condition (auxiliary steaming) was evaluated. Furthermore, only engineering personnel active in machinery spaces were included since these groups are believed to be exposed to the highest noise environment.

1.4 Report Organization

This report is organized as follows: Section 2 discusses the broad outline of the data management system, its elements, the analytic model on which it is based and the specifics associated with the shipboard occupational noise exposure application. Section 3 discusses the development of the data acquisition procedures, the organization and the field data collection history. Section 4 presents the survey results, the analysis of the analytical model predictions and comparisons of the results with dosimetry measurements conducted to validate this methodology. Finally, Section 5 summarizes the results and limitations of this study and presents recommendations.

2.0 THE NOISE EXPOSURE DATA MANAGEMENT SYSTEM

2.1 Background

The fundamental objective of the Navy Hearing Conservation Program is the prevention of occupationally induced hearing loss. However, to date, no system exists for evaluating consistently the magnitude of the shipboard noise exposure problem, identifying hazardous occupations and identifying unsafe work areas.

Noise exposure rather than noise level is the critical quantity in hearing conservation. Noise exposure is the time integral of noise level over an individual's duration of exposure, calculated with an appropriate exchange rate between level and time. The critical point here is that noise exposure relates to an individual (or individuals performing the same job in specified locations), not solely to the noise levels in a particular space. Thus an important input to a noise exposure data base system is the identification of the time spent at various locations by individuals having a certain job classification. Note that these data are fundamental to any time and magnitude dependent environmental hazard such as noise, heat stress or airborne toxic agents.

The lack of noise exposure data found in the previous study [1] is not surprising since the computation of noise exposure is not a simple process. Briefly, this process involves the understanding of the relationship between two variables: (1) the noise hazard and how it varies from location to location on the ship, and (2) the personnel work assignment or duty as a function of location and time spent. The situation is further complicated by the various operational modes of the ship which effect both noise hazard and personnel assignment.

Before we discuss the specific questions investigated in this study, a general overview of the occupational noise exposure data management system as it is envisioned at this time is in order.

Why is there a need for a noise exposure data management system? In addition to the ability to evaluate the noise exposure accurately, the system provides for a standardized method for acquiring and compiling exposure related noise data which in turn permits the pooling of information from various sources for an overall Navy analysis. This approach also permits the assessment of not only individual ships but ship classes, changes in the ship class as a function of time and reconditioning efforts, comparisons of a ship to its class, and, by analyzing the input information, the identification of the ship spaces (or locations) which contribute most to the overexposure problem. However, the most persuasive argument for the data management program is the ability of the system to bring together, for the first time, shipboard noise exposure data and audiometric data. This last factor, when operational, will help the Navy to plan not only more effective hearing conservation programs, but also to develop the optimum strategy for noise control in present and future ship classes. The general exposure data management system extends beyond the purely shipboard application and even beyond the occupational noise exposure application. The extensions to the basic model are summarized in Section 2.3. The application to the shipboard occupational noise problem and the specific development of the data acquisition procedures investigated in this study are discussed in Section 2.2.

2.2 <u>The Shipboard Occupational Noise Exposure Problem</u>

The shipboard noise exposure and assessment model developed in the previous study [1] was formulated to evaluate the

occupational noise problem in two ship classes. This model, which for completeness is repeated in Appendix A,* can be extended to the entire fleet. The purpose of this study is to explore the acquisition problems associated with the data input needs of the model. That is, what type of data base is required to achieve outputs which are responsive to various Navy echelons? Can this input data be collected by Navy personnel? What is the accuracy that may be associated with this procedure?

The approach used to establish the data needs was to identify the type of results that are desired for a Navy-wide application. Some of these results are oriented around the local requirements where regional Environmental Preventative Medicine Units (EPMU) inspect an individual ship and advise the ship's C.O. of infractions and potential problems. Other results may be oriented towards the Headquarters level where evaluations of trends in ship classes, job categories, and hearing loss are desired. The basic capabilities of the system as envisioned presently are as follows:

1) To compute the noise exposure of shipboard personnel as prescribed by existing Navy Noise Standards.

2) To identify Navy personnel with excessive noise exposure based on the job classifications or duty.

3) To identify and classify shipboard spaces or locations which most contribute to the noise exposure problem and to provide for a method for rank-ordering these according to exposure.

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* The reader is encouraged to review the details of the model in Appendix A to better understand the following discussion and the dimensions of the problem.

4) To allow for the assessment of the benefit generated (reduction of noise exposure -- not noise level) by the introduction of specific noise controls on a given ship or class of ships.

5) To provide a method for the collection and analysis of audiometric data as a function of job description.

6) To allow the computation of noise exposure based on other than previously approved guidelines. For example, the exposure of job classifications over a typical 24-hour day for a number of ship operating modes over a year, or tour of duty, etc.

Based on the above discussions the basic elements of the ship noise exposure data management system are shown in Figure 2.1 as follows:

1) <u>Input parameters</u>. The input parameters are represented a description of the hazard (noise level), the description of the personnel work assignments for all ship operational modes, etc.

2) <u>Analytic Models</u>. The analytic models are represented by the mathematical and statistical relationships used to analyze the input data and arrive at the desired output parameters.

3) <u>Data Bank Systems</u>. The data bank system is represented by the software, hardware, software maintenance, and retrieval systems necessary to computerize the process.

4) <u>Output Parameters</u>. The output parameters are represented by the Navy-wide requirements for hearing conservation, planning, and shipboard noise abatement.

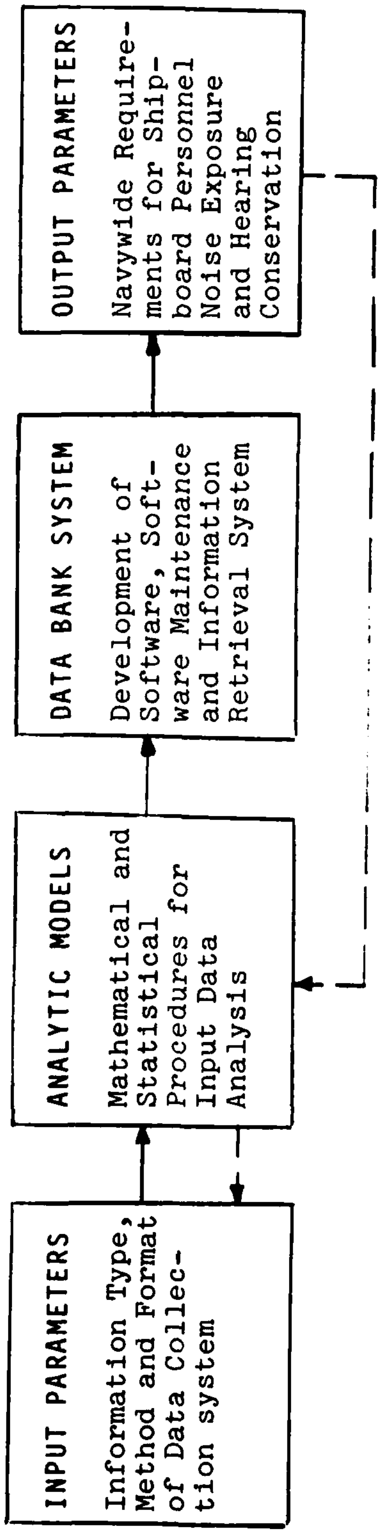


FIGURE 2.1 SCHEMATIC OF THE SHIPBOARD NOISE EXPOSURE DATA MANAGEMENT SYSTEM ELEMENTS

As indicated in Figure 2.1, the input parameters, in terms of the data type, quantity, format and method of acquisition are defined, to some extent, by the desired output parameters. For example, a requirement to compute a 24-hour noise exposure would necessitate noise and personnel assignment data for the entire 24-hour period instead of only the work hours. Similarly, if year-to-year improvements or changes in noise exposure are to be assessed, the input data must reflect the date of acquisition and must be stored accordingly in the data base system.

Central to the success of a Navy shipboard noise exposure data management system is the method by which the data are collected. At the present time most of the personnel noise exposure evaluations are conducted by the regional EMPUs which are located at various major Navy centers in the US and abroad. The subject of the specific procedures that the EPMUs follow in the data acquisition process is discussed further in Section 3.

In general the EPMUs conduct regular inspections of ships in their region. In the case of noise their mission is to identify noisy locations above 85 dBA and in some cases the causes of excessive noise, and to advise the ship's C.O. of the ship's status. As will be shown later, although the EPMUs purpose is to inspect the ship for noise exposure, they limit their measurements to quantifying the noise levels at various ship locations. At the present time the EPMUs do not routinely translate these physical measurements into comprehensive descriptions of personnel noise exposure. It is the intent of this program, through the Noise Exposure Data Management System, to adapt the present EPMU data collection practices to fulfill the data input requirements that will allow the computation of noise exposure. One of the main objectives of the work reported herein is to demonstrate the practicality and validity of the input data acquisition process using present EPMU capabilities.

2.3 Elements of the Noise Exposure Data Management System

The elements of the General Personnel Navy Exposure Data Management System and its possible extensions are shown in Figure 2.2. The matrix format is presented in terms of the four system elements discussed previously. Three of these elements, the input parameters, the analytic model, and the definition of the output parameters for the shipboard occupational noise exposure problem are the subject of the present work. Element number three which is concerned with the computerized version of the Shipboard Noise Exposure Model is not included in this phase and is discussed only in general.

The objective of the matrix presentation is to provide a picture of the possible extensions to the Shipboard Noise Exposure Data Management System which may be desired in terms of the output parameters and to show the interface that exists among the various elements of the system. For example, the extension of the Occupational Noise Exposure Assessment to watercraft and shore facilities is shown as a simple modification of the data collection procedures and an upgrade of the analytical model and software to account for the difference in the physical environment in that application. The resulting outputs will be identical to the shipboard application except that now job classifications and operational modes in watercraft and shore facilities will be considered.

The overall noise exposure application simply extends the capability of the system to account for the noise exposure perceived in other than working environments. This application is especially important in shipboard environments where the crew may be considered as a captive audience and the relief from high noise levels in other than work spaces is sometimes only minor. This application would allow the computation of a 24-hour day noise exposure parameter as a possible output. Current proposed

APPLICATION / ELEMENTS	SHIPBOARD OCCUPAT. NOISE EXPOSURE	EXTENSION TO WATERCRAFT/ SHORE FACILITIES	OVERALL NOISE EXPOSURE	AUDIOMETRY	SHIPBOARD/SHORE FACIL. MACHINERY NOISE CONTROL REQUIREMENTS	PERSONNEL EXPOSURE TO OTHER OCCUPAT. HAZARDS
INPUT PARAMETERS	1 Noise Level and Work Assignment Data Collection Procedures	5 Extension of Item 1 Procedures	9 Noise Level and Time Spent in other than Work Environments	13 Collection and Screening Procedures for Audiometric Data	17 Machinery Noise Characteristics and Classification Procedures	21 Physical Msmt. of Hazard(s) in Shipboard and Shore Facil. Procedures
ANALYTIC MODEL	2 Occupational Noise Exposure Computation Model	6 Extension of Item 2 Model	10 Extension of Items 2 or 6 to provide other time frame computation capability	14 Audiometric Data Analysis Model	18 Noise Source Diagnostic and Evaluation Model	22 Extension of Items 2 or 6 to provide hazard computational capability
DATA BANK, RETRIEVAL SYSTEM	3 Software and Software Maintenance Development	7 Extension of Item 3	11 Extension of Items 3 or 7	15 Software and Software Maintenance Development	19 Software and Software Maintenance Development	23 Extension of Items 3 or 6
DEFINITION OF OUTPUT PARAMETERS (Type, Format)	4 • Noise Exposure by Job Classification • Change in Exposure by Operating Mode • Assessment of Ship/ Class Noise Exposure • Evaluation of Ship/ Class Compliance with Standard • Identification of Ship/ Class Year to Year Improvement/Degradation • Identification and Classification of Noisy Spaces	8 Extension of Item 4 to describe watercraft and shore facility occupational noise exposure	12 Extension of Items 4 or 8 to provide: • 24-Hour Exposure by Job Classification • Yearly Noise Exposure by Job Classification	16 • Identification of Hazardous Occupations • Development of Hearing Loss Trends by Job Classification and Time of Service • Correlation between Noise Exposure and Hearing Loss Trends	20 • Identification and Classification of Major Noise Sources Based on Noise Exposure • Definition of Noise Reduction Requirements	24 Extension of Items 4 or 8 to describe other hazard(s) occupational exposure

FIGURE 2.2 NOISE EXPOSURE DATA MANAGEMENT SYSTEM AND POSSIBLE EXTENSION ELEMENTS

standards by the U.S. Coast Guard and by IMCO (International Maritime Organization) tend to suggest that the shipboard application problem in terms of hearing loss should be looked at on a 24-hour basis rather than only on the workday hours.

One important parameter of concern in the hearing conservation program which was mentioned before is the use of audiometric data to monitor the effects of the noise hazard. Which occupations are the most hazardous from the point of view of noise? At the present time the audiometric data collected is stored and used at the individual's level or command only. That is, the data, when available, are part of the individual's medical record and are not, to any extent, used on a Navy-wide basis to define hazardous occupations. This information, however, in concert with the noise exposure data could, and should be used, to formulate hearing conservation and education programs to evaluate and validate the long term effects of noise control actions and to define priorities in noise control efforts. The format of the shipboard noise exposure model lends itself to the storage of audiometric data along with the description of the individual's assignment. While it is not envisioned that individual histories can be monitored in this manner, statistical trends of job assignments can be easily derived as a function of length of duty, ship class, etc.

Of special interest, therefore, is the potential audiometry application of the data management system to monitor audiometric data for the same job classifications, compute hearing loss trends, and correlate hearing loss with noise exposure results for the same population groups. Note that the relationship between the audiometric model and the shipboard noise exposure model must be established so audiometric and noise data for the same population groups may be considered.

The analytical models for the shipboard-shore facility noise control and other occupational hazards (time and magnitude dependent) have already been developed in Reference 1. The only requirement for these applications to the system are the input data type and procedures which are necessary as shown in Figure 2.1.

Each one of the above application extensions to the basic shipboard Noise Exposure Data Management System is independent. Therefore a selection of one or more applications to be added to the system may be made in any desired sequence and at any time as the need arises.

3.0 DATA ACQUISITION PROCEDURES AND MODEL VALIDATION

This section of the report presents the procedures developed for the collection of noise and personnel work assignment data. Also included is a description of the methodology used to validate the results of the model and the specifics of the data base required.

3.1 Data Input Requirements

3.1.1 Selection of Ship Class

As described in Appendix A the shipboard noise exposure model is based on the assumption that the steady state condition can be described for both the hazard (noise levels) and the operator duty (personnel assignment). To accomplish this, both the ship class and the ship operating mode has to be constant. The selection of the FF-1052 (Knox) Class was based on two considerations:

(a) previous experience with this class which was investigated under a separate study [Ref. 1], and

(b) the large number of vessels in this class operational in the fleet.

This last consideration was especially important since the availability of ships of the same class for the special surveys to be undertaken was of prime importance.

3.1.2 Selection of the Ship Operational Mode

In order to maximize the use of the data base collected a single operational mode was selected. The selection of the "auxiliary steaming" operational mode meant that all measurements could be

performed while the ship was in port. Since the bulk of the data acquisition program was to be performed by the Environmental Preventative Medical Units (EPMU), this approach would limit the time required for the data collection process and control costs. It was estimated that each ship could be surveyed "in port" during an 8 to 12 hours period while a similar survey of "underway" operational mode would require a minimum of two days or more depending on the length of the trip. Furthermore this selection would preclude extensive travel by the EPMU personnel participating by choosing ships which were in the port where the units are based.

3.1.3 Number of Ship Surveys Required

Based on the FF-1052 Class noise data collected in Reference 1, a preliminary assessment of the expected data variability (from space to space and from ship to ship) was made. This information was used to estimate the number of ships that would be required in order to provide a statistically significant sample for this program. The minimum number of independent sample ships required was found to be 12. Based on this requirement it was estimated that a period of 3-months would be sufficient to collect the field data.

3.2 EPMU Procedures and Capabilities

At the onset of the program two regional EPMU units were selected to support the data acquisition program. These were

1. EPMU-2 based in Norfolk, Virginia, and

2. EPMU-5 based in San Diego, California.

With the assistance of BUMED the Commanding Officers of the two units were contacted and a general agreement to conduct the

surveys was gained. As a first order of business an introductory visit to each unit was undertaken. The objective was to establish their capabilities in the area of noise and become familiar with the general procedures used by the units in the performance of noise surveys. It was also desired to determine the level of training and instrumentation available to these units since the objective of the data collection system was to design the methodology around existing procedures. The results of the initial visits can be summarized as follows:

1. EPMU units conduct noise surveys either in port or underway at the request of the ship's Commanding Officer.

2. These surveys are normally oriented around measurement in noisy ship's areas and in most cases involve surveys of the engineering spaces in question.

3. No Navy-wide coordinated system for noise data acquisition exists among the EPMU units. Each unit, over time, has developed their own procedures of how to conduct the survey and what data to collect.

4. In general noise levels are acquired only at locations where noise levels exceed 85 decibels. (Prior to DOD Instr. 6055.3 this cut-off was generally at 90 decibels.)

5. There are no standardized measurement locations at which levels are acquired. That is, although some consistency in the general procedure that each EPMU unit follows was found, the specific locations surveyed in each space and the number of measurements selected depends to a large extent on the individual conducting the survey. Also, the ship's operational conditions, although in most cases noted, is not uniform. Thus, while most of the available data are collected "underway", differences due to ship's speed are normally not taken into account. In general,

the tendency was to measure at locations where noise levels were the highest (worst condition).

6. Surveys were normally limited to noise measurements at one or more locations within the engineering spaces without regard as operator location or duration of exposure.

7. Equipment available to EPMU units is usually limited to Type 2 sound level meters.

3.3 Development of Data Collection Procedures

This section describes the general process followed in the development of the Sound Survey Forms used during the survey and the procedures used to acquire the data.

3.3.1 Noise Survey Forms

The main objective in the development of the Sound Survey Forms was to provide a standardized format for a data acquisition system that would be consistent with the information required in the shipboard noise exposure model (Ref. 1) and with the general procedures and capabilities of the EPMU units. With this in mind the Sound Survey Form in Appendix B has been developed. This form was developed for each one of the engineering spaces (or subspaces) of concern. A sample page is shown in Figure 3.1.

Figure 3.1 shows the form developed for the Engine Room-Lower Level. Similar forms have been developed for the Engine Room-Upper Level, Engine Room-Second Deck, Fire Room-Upper Level, Fire Room-Lower Level, Fire Room-Second Deck, Auxiliary Room #1-Lower Level, the Auxiliary Room #1-Upper Level, Auxiliary Room #2 and finally for the FD-Boiler Room 1A, FD-Boiler Room 1B and the After-Steering Space.

The front part of the form is sub-divided into four distinct areas. These are:

1. General information,

2. Operating conditions,

3. Sound level data,

4. Personnel assignment data.

The back of the form contains supportive information to the survey requirements identified in the front.

It should be noted that the general elements of this form are common to any ship class that may be surveyed. However, the details, especially those associated with the number of acoustic spaces identified, the selection of measurement locations and the machinery layout arrangements, are unique to the FF-1052 Class.

It is hoped that some version of a Sound Survey Form like the one suggested here will be adopted for all EPMU units and that comparable forms be developed for each ship class in the fleet.

3.3.1.1 General Information

The general information part of the survey form contains the basic identification data for the ship surveyed. Such information as the ship class and the space designation are contained here as shown in Figure 3.1. The ship name, survey date, time of day and type of instrumentation used is also identified. This information is necessary to not only identify the ship but also to make the attached information useful in later analysis; for example, when this ship is compared to itself at future

FF1052 Class

SOUND SURVEY FORM

CODE	GENERAL INFORMATION		CODE	OPERATING CONDITIONS	
	Ship's Class	FF1052 KNOX		Readiness ①	Cond. I ☐ Cond. III ☐
	Space Surveyed	Engine Rm. Lower Level			Cond. IV ☐ Cond. V ☐
	Ship's Name	____________		Operating Mode	
	Survey Date	___/___/___		(a) In-Port	Cold Iron ☐
	Time of Day	____________			Aux. Steaming ☐
	Inspected by	____________		(b) Underway	Speed ______kts
	Meter Type	____________			Shaft ______rpm
	Serial Number	____________			

SOUND LEVEL DATA

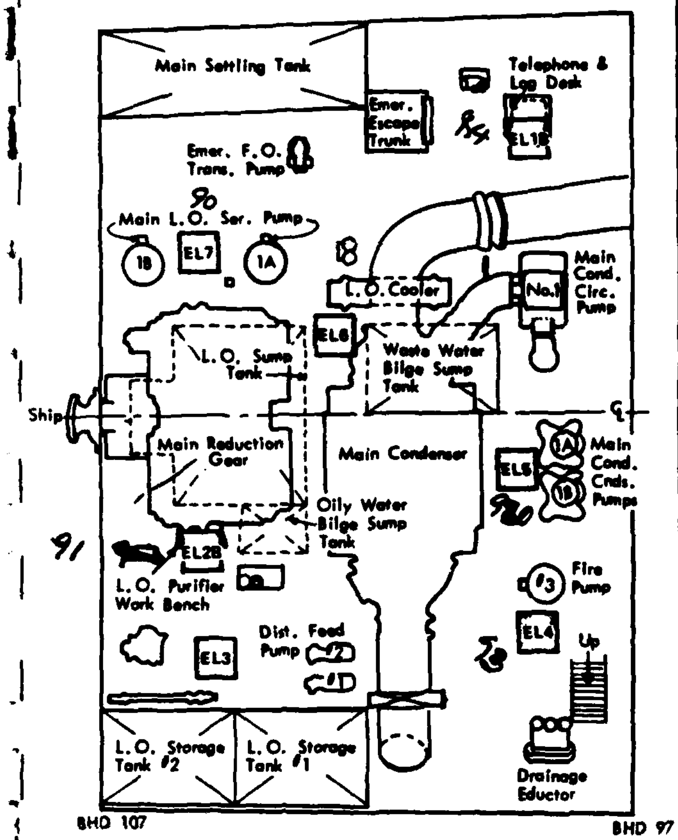
LOC. CODE	MEAS. LOC.	dBA	INTER ② ?	COMMENTS ③	LOC. CODE	MEAS. LOC.	dBA	INTER. ?	COMMENTS
	EL1B					EL6			
	EL2B					EL7			
	EL3								
	EL4								
	EL5								

PERSONNEL ASSIGNMENT DATA

LOC. CODE	MEAS. ④ LOC.	BILLET TITLE	RATE ⑤	WEAR ⑥ PROT. ?	WATCH ⑦ STAND ?	HRS./DAY AT LOC. ⑧		COMMENTS ⑨
						WORK	WATCH	

Figure 3.1 Illustration of the Sound Survey Form

SPACE: Engine Rm. Lower Level



MACHINERY LINE-UP (OPTIONAL)

CODE	DESCRIPTION	ON(√)
	Main Reduction Gear	
	Main Condensate Pump 1A	
	Main Condensate Pump 1B	
	Fire Pump No. 3	
	Main Condensate Circulation Pump No. 1	
	Main L.O. Service Pump 1A	
	Main L.O. Service Pump 1B	
	L.O. Purifier No. 1	
	Distillate Feed Pump No. 1	
	Distillate Feed Pump No. 2	
	Drainage Eductor	
	Emergency F.O. Transfer Pump	

DEFINITION OF PERSONNEL RATES

RATE	RATE DESCRIPTION	DIVISION
MMC	Machinist Mate - Chief	A
MM1	Machinist Mate - 1st Class	A
MM2	Machinist Mate - 2nd Class	A
MM3	Machinist Mate - 3rd Class	A
MMFN	Machinist Mate - Fireman	A
FN	Fireman	A
BTCM	Boiler Tender - Master Chief	B
BT1	Boiler Tender - 1st Class	B
BT2	Boiler Tender - 2nd Class	B
BT3	Boiler Tender - 3rd Class	B
BTFN	Boiler Tender - Fireman	B
EMC	Electrician Mate - Chief	E
EM1	Electrician Mate - 1st Class	E
EM2	Electrician Mate - 2nd Class	E
EM3	Electrician Mate - 3rd Class	E
EMFN	Electrician Mate - Fireman	E
MMCS	Machinist Mate - Senior Chief	M
MM1	Machinist Mate - 1st Class	M
MM2	Machinist Mate - 2nd Class	M
MM3	Machinist Mate - 3rd Class	M
MMFN	Machinist Mate - Fireman	M
FN	Fireman	M

DEFINITIONS & AMPLIFICATIONS

① Readiness	Cond. I - General Quarters Cond. III - Wartime Steaming Cond. IV - Peacetime Steaming Cond. V - In-Port
② Inter. ?	Stands for "is the noise level intermittent?" The question mark (?) requires a "yes" or "no" answer. Intermittent noise is defined as the sound generated by machinery which is cycled on and off and results in large fluctuations in noise levels (more than 5 dBA).
③ Comments	Should be used to note faulty machinery or any other factor that, by inspection, may be responsible for an unusual noise environment at the measurement location.
④ Meas. Loc.	Enter the sound level measurement symbol which is located closest to the individual's position (see Figure).
⑤ Rate	Enter individual's rate abbreviation as shown on the personnel rate table; i.e. Boiler Tender, First Class-BT1.
⑥ Wear Prot. ?	Stands for "is the individual wearing personal hearing protection?" such as earplugs or earmuffs. The question mark (?) requires an "yes" or "no" answer.
⑦ Watch Stand ?	Stands for "is the individual a watch stander or a watch stander trainee?". The question mark (?) requires a "yes" or "no" answer.
⑧ Hrs/Day at Loc.	Enter the number of hours (to closest ¼ hour) that the individual works at location. If answer is "yes" to ⑦ enter number of hours spent as a watch stander at location.
⑨ Comments	Should be used to describe work task when appropriate.

times or when it is compared to other ships of the same class. Note that a column marked "Code" is located to the left of General Information section as well as the other sections in the form. This column is designed to eventually carry the designation code to be used in a computerized version of the model for storage and information retrieval purposes.

3.3.1.2 Operating Conditions

The operating conditions section of the Sound Survey Form contains the basic information necessary to identify the operating condition of the ship. This is necessary since, as pointed out in the discussion of the model, both the sound level and the personnel assignment data are believed to vary depending on the operating condition of the ship. The information required is self-explanatory. In addition to the readiness, the operating mode of the ship is noted as "cold iron", "auxiliary steaming" or "underway"; in the case of the latter, the speed and shaft rpm are also noted. Further identification of the readiness condition is provided on the back of the form under Item 1.

3.3.1.3 Sound Level Data

This section of the form contains the basic sound level data to be acquired. Each location to be surveyed is identified under the column called "Measurement Location" with a specific code number. In the case of the Engine Room-Upper Level, eight such locations have been identified. In order to assure that the measurements are taken always at the same locations, a floor plan of each space is provided on the back of the form and each measurement position is identified by the corresponding code number. Spaces for the noise measurements, the type of noise levels measured and comments are provided. Further definitions and amplifications to the noise data are provided on the back of the form under Items 2 and 3. The objective, here obviously, is

to assure repeatability of measurements that are made under the same conditions, in the same location and in the same manner. Finally, the back of the form contains a machinery line-up. This information, which is optional to the survey procedure, is designed as a check of the major machinery items which are operating in the space at the time of the survey. Large variability in noise levels from ship to ship or for the same ship could be explained with this information, by noting if the same equipment line-up is operating.

3.3.1.4 Personnel Assignment Data

The final entry in the Sound Survey Form is entitled "Personnel Assignment Data" and deals with the amount of time different engineering personnel spent at various locations in the engineering spaces. In other words, the objective of this section is to acquire data that may be used to establish a statistical time-motion description of all engineering personnel work assignments on the ship. The design of the form is based on the premise that engineering personnel spent their working hours in one of two job assignments: a) as a watch stander, and b) as a worker. Thus, during the survey, when an engineering division person is identified, the surveyor would determine the closest location in the space at which the operator is standing and enter the proper measurement location. Then, he would proceed to question the individual as to his identification information, such as his billet title and the rate. Finally, he would determine the particular details of the individual's job at the time, specifically, the amount of time spent at this location. For example, if the individual is a watch stander, he will proceed to identify the length of the watch, and the number of hours for that assignment will be entered under "watch". If the individual is performing a work task, say cleaning, the number of hours that he performs that work at that location will be entered under "work". Comments are provided for additional

data. The back of the form contains a number of definitions of personnel rates and other support information necessary to complete the form in the proper manner (see Items 4 through 9). Further explanations on the actual procedure for the data acquisition process are provided in the next section on survey methodology.

3.3.2 Survey Methodology

In support of the noise survey forms discussed in the previous section a shipboard sound survey procedure was also developed. The objective of this procedure was to take the user (EPMU personnel) through a step-by-step procedure on how to use the noise survey forms and how to acquire the required sound level and personnel assignment data. Emphasis was placed on the actual measurement procedure and personnel assignment data acquistion process. Special survey techniques were developed in order to ensure that uniform sound level data measurement procedures would be used by different individuals and different units within the Navy participating in the program. Attention was also placed in explaining the personnel assignment data acquisition process since this type of information is a new requirement and is not a part of the typical EPMU surveys. The key to this end is the identification of engineering personnel and the time spent at the sound measurement location where they were found. The complete "Shipboard Sound Survey" procedure is shown in Appendix C.

3.3.3 Special Study Requirements

As was pointed out, the acquisition of data on the operator duty or personnel assignment for a typical survey would be limited only to the individuals present in the space during the sound level survey. No effort should be expended to locate all engineering personnel assigned to each space. This approach, in

most cases, precludes the identification of all engineering personnel and certainly the establishment of the entire daily noise exposure for each individual. Under normal survey conditions, reliance on information from many ships in the same class is placed to establish statistically valid operator duty assignments. However, in order to increase the data base available for this particular study, the EPMU personnel were also asked to undertake an independent personnel assignment survey following the routine procedure just described. This independent personnel assignment survey was designed to establish the entire day's personnel assignment data for all engineering personnel on the ship. Thus, although the normal procedure relied on the statistics of many ships measured to describe the daily work assignment of various personnel ratings, this study required a full documentation on the personnel movements in order to evaluate the accuracy of the method with a limited data base.

3.4 Experimental Validation of the Data Base

The validation of the analytical noise exposure model and the data base collected was untertaken through the collection of an independent set of noise exposure measurements. These measurements were collected concurrently with the acquisition of the data base through the dosimetry measurements of engineering personnel. Table 4.1 contains the summary of the ships in which dosimetry measurements were acquired. Whenever possible the dosimeter measurements were oriented around the fireman (BT) rate in order to maximize the amount of data acquired in the limited sample of individuals, thus allowing us to develop the proper statistics for comparison purposes.

3.5 Field Data Collection

This section describes the data collection undertaken during the field survey part of the program.

3.5.1 EPMU Briefings

As a kickoff to the data collection process conducted by the two EPMU units, a one-day briefing was organized both in the San Diego, California and in the Norfolk, Virginia facilities. A half-day session on the data collection system procedures and the sound survey form was organized. In both cases all EPMU personnel associated with noise level measurements participated. The objective of these briefings, in addition to explaining the forms and the procedure, was to acquaint the units with the objectives of the program and to explain the basic concept of the analytical model on which it was based. Preliminary plans for getting access to the ships and potential measurement schedules were also developed during this period.

3.5.2 Data Collection Problems and Time Delays

The original three-month time assigned for the collection of data on 12 FF-1052 ships was eventually extended to a period of over two years. The difficulties encountered in finding and receiving permission for ship surveys in this class were many. However the most important ones can be summarized as follows:

1. The selection of the auxiliary steaming operating condition proved to be a very severe stumbling block. It was found that ships rarely stayed in that condition for any extended period of time and thus it was difficult to plan ahead as to the specific time that condition would be available. In many cases ships that were due to be surveyed had changed their orders and were either underway during the date of the survey or the auxiliary steaming condition could not be maintained for a sufficient length of time to perform the measurements.

2. A further problem associated with the auxiliary steaming operating condition was that when ships were found in that condition, many of the engineering personnel who would typically be working in engineering spaces in an underway mode were assigned to other duties on the ship or were on leave from the ship.

3. In several cases it was impossible to gain the approval of the Commanding Officer to perform the survey.

These lengthy time delays created other problems, mostly related to the continuity of the project as well as to the training of the EPMU personnel, who in many instances had changed over the two-year period.

3.5.3 The Dosimeter Measurements

Six of the 12 ships surveyed during this study were also subject to the independent experimental data validation process using dosimeters. The objective in all cases was to measure the actual noise exposure problem for several individuals on the ship while the noise survey and the personnel assignment survey were taking place. Typically six individuals could be monitored at one time and in most cases the selection of these individuals was intended to be within the same rate or closely related rate so that a significant statistical sample could be obtained. These same individuals were later interviewed in terms of their time spent at different locations, in order to establish the noise exposure using the model. Table 4.1 has a summary of the ships in which dosimeter measurements were taken.

The difficulties encountered during the acquisition of the dosimeter data can be summarized along two lines. First, the instrumentation used (or available) for this purpose varied over the two-year span. For example, some of the early data were

acquired with a 90 dB threshold and a 5 dB exchange rate between level and time which corresponded to the BUMED Instr. 6260.6 noise standard in effect at the time when this program was initiated. Later when the Navy standard changed to the 84 dB/8-hour exposure with a 4 dB exchange rate (DOD Instr. 6055.3) several of the dosimeter measurements were taken with instrumentation that was set to measure exposure along the new guidelines. This lack of comparability created several problems later on when the data were compared from ship to ship.

Secondly, problems were encountered with several of the dosimeters malfunctioning during the survey. Although each instrument was checked thoroughly and calibrated before each field trip, failures due to either instrumentation related problems or the subject were encountered. The latter was due to individuals hitting the microphone or the instrument causing obviously erroneous readings. This experience seems to reflect the conclusions of other dosimetry studies reported in the literature. The suggested solution is to perform the measurements over several days and discard the first one or two days under the assumption that the user will become accustomed to the process. This approach also allows for data averaging from day-to-day.

3.5.4 Summary of Ships Surveyed

Table 4.1 shows the summary of all the ships that were surveyed and the dates of each survey. In one case the same ship was surveyed twice, this being due to the availability of ships and the desire to complete the data acquisition procedure as soon as possible. As was pointed out, although in all cases the noise level measurements were acquired successfully, the personnel noise assignment data for some of the ships was limited to the number of people that were on the ship at a given time and not on leave, and also to the number of people that were actually working or watch standing in the engineering spaces rather than being assigned to other jobs on the ship.

3.5.5 Debriefing of EPMUs

At the completion of all the surveys a short debriefing of all personnel involved in the noise surveys was conducted. This debriefing also took place after the survey of each ship was completed, through telephone communication with the people involved and also by notations provided by them on the results for each ship. Most of the important questions which needed to be addressed and which concerned the variability and difficulty of the survey procedures were answered in these debriefings.

One of the most important factors noted was the time associated with conducting the surveys. It was found that while more information was being sought, especially in terms of additional noise measurements and additional personnel assignment data requested, the amount of time necessary to complete the survey was in no way longer than previously experienced by these units. The reasons for this were twofold: the present surveys were very systematic in terms of the decision process used by the individual performing the measurements; and the additional data requested on personnel assignments were not sufficient to extend the period of the survey over what had been experienced previously. On the average between four and six hours were necessary to complete the cycle.

4.0 SURVEY RESULTS

4.1 Introduction

Data resulting from the shipboard surveys may be divided into three categories: A weighted sound level data (Leq - dBA), as a function of location and ship; personnel assignment data in terms of hours spent at specified locations for each personnel category; and dosimetry data which were acquired by instrumentation attached directly to selected personnel. The sound level and personnel work assignment data are used to calculate noise exposure for each personnel category; the dosimetry data give the noise exposure results directly. Data were collected for eleven FF1052 Knox class ships (see Table 4-1), all of which were in port and operating in the auxiliary steaming condition. One of the ships (FF1097) was surveyed twice to provide a total of twelve sets of data.

In the following sections the sound level, work assignment and dosimetry data are summarized; personnel noise exposures are then calculated using the sound level and work assignment data first of all and then by using the dosimetry data. Finally, these noise exposure results are compared with the results obtained using the dosimeters.

4.2 Summary of Survey Data

4.2.1 Sound Level Data

For each of the twelve sample ships sound level data were recorded in each of the twelve engineering spaces in the following list.

1. Engine room, lower level - ELT
2. Engine room, upper level - EUT

TABLE 4-1. SUMMARY OF FF1052 CLASS (KNOX) SHIPS SURVEYED BY EPMU UNITS

NO.	SURVEY	SHIP DESIGNATION		EPMU PERFORMING SURVEY	DOSIMETRY DATA TAKEN
1	2/10/79	FF-1083	USS Cook	5	No
2	2/27/79	FF-1065	USS Stein	5	No
3	2/27/79	FF-1084	USS Candless	2	No
4	3/15/79	FF-1090	USS Ainsworth	2	No
5	4/27/79	FF-1091	USS Miller	2	No
6	5/16/79	FF-1097	USS Moinester	2	No
7	8/09/79	FF-1085	USS Pharris	2	Yes
8	8/09/79	FF-1085	USS Beary	2	Yes
9	2/04/80	FF-1092	USS Hart	2	Yes
10	2/14/80	FF-1081	USS Aylwin	2	Yes
11	8/27/80	FF-1097	USS Moinester	2	Yes
12	12/14/80	FF-1075	USS Trippe	2	Yes

3. Engine room, second deck - EST
4. Fire room, lower level - FLT
5. Fire room, upper level - FUT
6. Fire room, second deck - FST
7. Auxiliary room No. 1, lower level - ALT
8. Auxiliary room No. 1, upper level - AUT
9. Auxiliary room No. 2 - XRT
10. Forced draft blower (FDB) room 1A - FAT
11. Forced draft blower (FDB) room 1B - FBT
12. After steering - ST

In each of these engineering spaces, measurements were made on the twelve sample ships at 3 to 10 personnel locations, providing a two-way array of data for ship number versus measurement location, as shown in Table 4-2.

Of interest are the variations in the measured noise levels in various engineering spaces: (a) among the measurement locations in a given engineering space, (b) among the ships in the sample for a given engineering space, and (c) among measurements made under similar conditions (that is, the measurement or sampling error).

Conventional two-way analysis of variance calculations [2] were performed on each of the arrays in Table 4-2 to determine the variability among measurement locations and ships in terms of F variables. The computed F values (F_{comp}) for each engineering space and the corresponding F values for homogeneous data at the 1% level of significance ($F_{0.01}$) are presented in Table 4-3.

The variablilty among ships indicates whether or not any variation in the data is due to inherent differences among ships; if the variation is below the 1% level of significance then the implication is that similar variations may be expected if the same ship were sampled 12 times on different occasions. The

TABLE 4-2(a). SHIP SOUND LEVEL DATA - AUXILIARY STEAMING

Engineering Area	Measur. locat.	Sound Level in dBA by Ship Number											
		FF-1081	FF-1092	FF-1085	FF-1094	FF-1090	FF-1091	FF-1083	FF-1065	FF-1097	FF-1084	FF-1097	FF-1075
Engine Room Lower Level	EL1B	84	85	85	86	81	80	86	86	81	84	84	86
	EL2B	89	90	91	89	83	87	86	87	86	87	86	85
	EL3	89	94	92	89	84	87	86	91	86	88	86	87
	EL4	94	95	94	86	89	93	93	96	90	91	87	80
	EL5	91	92	91	90	88	89	84	89	86	86	85	81
	EL6	90	86	87	84	79	85	88	84	84	81	86	84
	EL7	86	88	89	92	77	87	93	86	84	78	89	88
Engine Room Upper Level	EU1W	89	89	92	90	85	89	85	87	88	86	88	84
	EU2B	77	78	85	82	78	81	84	84	85	74	87	87
	EU3	84	86	84	89	88	78	83	85	80	83	81	86
	EU4	85	89	83	91	83	81	80	83	80	83	81	82
	EU5	86	86	87	84	83	86	82	86	82	85	84	82
	EU6	86	86	88	85	82	89	82	82	81	83	84	86
	EU7	84	84	87	83	79	86	83	81	81	79	83	90
	EU8	81	82	85	85	80	83	84	84	81	77	85	91
Engine Room Second Deck	ES1W	64	68	71	75	66	64	68	68	65	59	69	70
	ES2	78	80	78	84	80	80	79	81	77	76	79	80
	ES3	81	82	84	85	79	81	79	81	79	79	82	81
	ES4	85	84	87	83	80	84	81	84	82	82	84	83

TABLE 4-2(b). SHIP SOUND LEVEL DATA - AUXILIARY STEAMING

Engineering Area	Measur. locat.	Sound Level in dBA by Ship Number											
		FF-1081	FF-1092	FF-1085	FF-1094	FF-1090	FF-1091	FF-1083	FF-1065	FF-1097	FF-1084	FF-1097	FF-1075
File Room Lower Level	FL1W	87	88	91	85	80	84	86	85	90	82	88	88
	FL2B	88	58?	91	90	92	82	88	86	90	86	88	82
	FL3B	84	84	85	82	79	84	85	83	85	78	87	88
	FL4	91	90	89	81	74	81	92	82	84	80	83	86
	FL5	88	84	96	82	75	78	88	85	90	81	85	85
	FL6	87	85	90	88	81	82	84	86	91	81	83	84
	FL7	88	86	91	89	83	86	83	84	91	82	86	84
	FL8	88	86	89	87	90	82	88	87	89	86	89	82
	FL9	93	83	91	85	87	83	87	86	92	81	94	82
	FL10	87	85	90	90	85	86	85	87	88	87	88	85
File Room Upper Level	FU1W	75	61	72	75	65	74	68	67	74	65	77	68
	FU2W	93	88	92	92	82	89	87	88	95	87	93	92
	FU3B	84	81	92	88	73	83	88	84	85	81	86	85
	FU4	88	82	101	82	77	82	83	85	95	83	86	86
	FU5	94	86	97	88	82	84	86	86	94	86	93	89
	FU6	89	84	91	85	81	83	88	84	91	84	85	88
	FU7	92	88	91	89	88	83	90	89	104	87	92	89
	FU8	92	86	92	86	89	79	90	92	96	87	91	90
	FU9	97	85	90	82	85	82	89	84	95	81	88	83
	FU10	86	84	91	80	80	87	89	86	92	80	91	86

TABLE 4-2(c). SHIP SOUND LEVEL DATA - AUXILIARY STEAMING

Engineering Area	Measur. loca.	Sound Level in dBA by Ship Number											
		FF-1081	FF-1092	FF-1085	FF-1094	FF-1090	FF-1091	FF-1093	FF-1065	FF-1097	FF-1084	FF-1097	FF-1075
File Room Lower Level	FS1	93	88	92	92	85	93	90	94	99	91	100	91
	FS2	88	87	91	83	78	83	86	84	92	80	94	92
	FS3	95	85	93	86	82	88	88	88	94	83	87	89
Aux. Room No. 1 Lower Level	AL1	90	85	88	88	89	85	91	89	92	88	88	86
	AL2	91	89	96	93	92	84	92	92	93	92	91	91
	AL3	91	88	93	86	92	86	90	93	95	90	90	89
	AL4	89	86	92	87	91	87	89	94	92	87	90	89
	AL5	90	82	91	88	90	86	95	96	88	88	92	91
	AL6	92	85	95	86	91	87	87	92	91	86	91	91
	AL7	87	83	92	84	88	86	89	90	89	84	91	87
Aux. Room No. 1 Upper Level	AU1B	86	80	87	89	87	80	86	86	87	86	85	85
	AU2B	88	80	86	90	85	85	86	86	88	84	84	82
	AU3	87	83	88	90	88	84	88	85	90	88	86	87
	AU4	88	88	87	89	90	84	87	88	91	88	87	88
	AU5	87	85	91	89	86	83	89	90	90	87	88	86
	AU6	85	84	91	88	85	89	86	87	87	84	88	88
	AU7	83	91	92	91	83	91	93+	87	91	87	86	88
	AU8	87	84	89	91	85	87	89+	91	84	83	85	87

TABLE 4-2(d). SHIP SOUND LEVEL DATA - AUXILIARY STEAMING

Engineering Area	Measur. loca.	Sound Level in dBA by Ship Number											
		FF-1081	FF-1092	FF-1085	FF-1094	FF-1090	FF-1091	FF-1083	FF-1065	FF-1097	FF-1084	FF-1097	FF-1075
Aux. Room No. 2	X1W	61	73	104	62	107	64	73	60	60	105	72	56
	X2	64	76	106	65	103	67	80	62	63	101	80	56
	X3	70	73	104	72	100	64	62	67	65	102	71	56
	X4W	62	58	75	62	76	52	55	63	49	77	82	62
	X5	92	85	93	70	89	61	87	66	58	96	86	60
	X6	73	88	92	79	91	75	58	62	86	82	77	62
FDB Room 1A	FA1	94	84	86	84	79	68	80	82	83	-	84	92
	FA2	97	78	85	80	78	67	77	76	81	-	85	80
	FA3	90	83	84	81	74	66	78	84	81	-	83	82
FDB Room 1B	FB1	85	75	75	80	66	64	77	79	88	70	75	74
	FB2	84	72	74	81	65	62	68	78	84	74	73	74
	FB3	83	70	72	79	65	65	79	77	89	73	80	74
After Steering	S1W	53	50	67	57	69 99?	-	↓50	67	67	73	70	68
	S2B	52	50	66	56	61	-	↓50	69	65	70	66	68
	S3	59	52	71	57	70	-	↓50	74	71	69	69	68
	S4	54	52	71	52	76	-	↓50	76	74	63	71	68

TABLE 4-3. RESULTS OF ANALYSIS OF VARIANCE STUDIES OF SHIP NOISE MEASUREMENTS

Region in Ship	Sample Size		Variation of Noise Level with Measurement Location		Variation in Space Aver. Noise Levels with Ship Number		Standard Deviation	
	Locations	Ships	$F_{comp.}$	$F_{0.01}$	$F_{comp.}$	$F_{0.01}$	s_e	s_t
Engine room, lower level	7	12	7.4	3.1	4.5	2.5	2.79	3.88
Engine room, upper level	8	12	4.3	2.9	2.7	2.5	2.83	3.40
Engine room, second deck	4	12	>100	4.4	4.2	2.8	1.97	6.78
Fire room, lower level	10	12	2.4*	2.6	2.5	2.4	2.89	3.80
Fire room, upper level	10	12	42.1	2.6	14.1	2.4	3.11	7.18
Fire room, second deck	3	12	13.9	5.7	5.7	3.2	2.79	5.00
Aux. room No.1, lower level	7	12	5.4	3.1	10.8	2.5	1.87	3.04
Aux. room No.2, upper level	8	12	2.4*	2.9	5.8	2.5	2.13	2.75
Aux. room No.2	6	12	4.9	3.4	14.9	2.6	8.38?	15.53
FDB room 1A	3	11	4.2*	5.8	17.9	3.4	2.65	6.74
FDB room 1B	3	12	1.6*	5.7	23.4	3.2	2.41	6.85
After Steering	4	10	2.9*	4.6	23.6	3.2	3.14	7.92

*Hypothesis of homogeneity accepted at 1% level of significance.

same reasoning can be used for the location data in the same space. That is, if the variation among locations is below the 1% level of significance, then similar results may be expected if the same location on any particular ship were sampled a number of times rather than sampling several locations once only; in other words, there are no inherent differences among locations in the same space.

Also shown in this table are the standard deviations of the measurements in each engineering space; including all effects due to variations among both location and ship (s_t) and the standard deviation due only to variations from ship to ship in the distribution of noise levels throughout a given space (s_e).

Note that the results reveal a statistically significant variation among the measurements on different ships in all twelve engineering spaces; that is, there are inherent differences among ships. A statistically significant variation among the measurements at different locations is also indicated for seven of the twelve engineering spaces; homogeneity among measurement locations is suggested only for (a) Fire room, lower level, (b) Auxiliary room No. 1, upper level, (c) FDB room 1A, (d) FDB room 1B, and (e) After steering.

Although there appear to be statistically significant variations in the measurements from ship to ship and location to location in most cases, the question remains as to whether these variations are of practical significance. The standard deviation results in Table 4-3 address this issue. Specifically, when the variations in noise levels among measurement locations in a given space and among ships for a given space, are removed from the total variability, the remaining variability in the results, as defined by the standard deviation s_e, is consistently between 2 and 3 dBA in most of the engineering spaces. The only major exception is Auxiliary room No.2 where the data are suspect. A weighted

average value of s_e over all engineering spaces is given by

$$s_e = \left[\frac{1}{n}\sum_{i=1}^{n} n_i s_{ei}^2\right]^{\frac{1}{2}} \qquad (4.1)$$

where n_i is the number of measurements and s_{ei} is the computed error standard deviation in the ith engineering space, and n is the total number of measurements. Using the data in Table 4-1 (excluding the suspicious Auxiliary Room No.2 result), Eq. 4.1 yields

$$s_e = 2.7 \text{ dBA} \qquad (4.2)$$

This is the best estimate for the measurement error; (that is, the standard deviation of measurements which were taken under similar conditions) and represents the probable error if one ship and one location in each area were sampled a number of times instead of sampling 12 ships and several locations only once.

Table 4-3 shows that the overall standard deviation s_t of the sampled data in some spaces is less then 1 dBA higher than s_e, for example in the engine room upper level and the auxiliary room no. 1 upper level. This suggests that variations due to exact location (in a given space) and ship are relatively small for these spaces; that is, most of the error is attributable to random sampling error and the total error is only slightly reduced by sampling several ships and locations in each space rather than sampling one ship and one location in each space on several different occasions.

In other engineering areas, however, the overall standard deviation s_t of the measurements far exceeds s_e; for example, in the FDB rooms and after steering. In most cases, this is due to large variations from ship to ship rather than among measurement

locations in a particular space. In the few cases where there is a large variation among locations in a particular space, it is usually due to a single measurement location which is quite different from all others, for example, ES1W in the engine room second deck and FU1W in the fire room upper level.

We may conclude the following for the shipboard noise level data:

1. Variations in noise level from location to location are due partly to inherent differences among locations but primarily due to random sampling error. That is, the scatter in results would be almost as large if one location in each space were sampled several times instead of several locations being sampled only once.

2. Variations in noise level from ship to ship are due partly to differences among ships and partly to random sampling error. The effect of differences among ships is larger than the effect of differences among locations in a given engineering space.

3. Noise level variations, both among locations in a particular engineering space and among ships, are large, as evidenced by the standard deviation data in Table 4-3.

4.2.2 Personnel Assignment Data

For each of the twelve sample ships, personnel assignment data were recorded for all personnel who were required to spend some time in an engineering space while the ship was operating in the auxiliary steaming condition. For any given personnel grade the quantity of interest is the variability in both the assignment locations and the amount of time spent at the assigned locations:

a) among the 12 ships in the sample, and

b) among personnel on the same ship.

Also of interest is the variability among measurements made under similar conditions; that is, the random sampling error.

The personnel assignment data were analyzed using a two dimensional analysis of variance on the data in Appendix D. Inspection of the Appendix D data shows that on a given ship there are many grades for which no data are available. The data resulting from the analysis of variance are presented in Table 4-4 in units of hours and in terms of F values (see preceding section) and standard deviations for each personnel grade. The F values for variations among ships are a measure of the variability from ship to ship due to inherent differences in each ship. The results show that out of 26 grades, the variability in the data for only 8 grades cannot be explained almost entirely by random sampling errors. Thus for the remaining 18 grades the results suggest that the scatter in the data would be almost as great if the same ship were sampled 12 times instead of sampling 12 different ships only once. This implies that the overall variability in the personnel assignment data is due mainly to random sampling errors rather than to inherent differences among ships and may be characterized by the standard deviation of the data for each personnel grade. The results are included in Table 4-4 and show that the variability is indeed very large.

We may conclude the following for the personnel assignment data.

1. The variability in the data from ship to ship for most of the personnel grades is due partly to inherent differences between ships but primarily to random sampling errors. That is, the scatter in results would be almost as great

Table 4-4 Personnel Assignment Data Variability

Personnel Grade	No. of Locs.	F values for variations among ships	Total Standard Deviation or mean error (hrs)
LCDR	1	insufficient data	0.16
ENS	10	3.17*	0.66
LTJG	15	3.69*	0.28
LT	12	1.27	0.78
ENFN	3	2.14	1.50
EN3	6	3.26*	1.31
EN2	1	insufficient data	0.36
EN1	6	1.41	1.12
EMFA	2	insufficient data	0.14
EMFN	3	insufficient data	1.12
EM3	14	1.16	0.47
EM2	9	1.38	0.51
EM1	5	2.80*	1.27
EMC	4	5.85*	0.65
FR	2	insufficient data	0.90
FA	5	4.70*	1.01
FN	17	2.72*	0.58
MMCS	3	1.44	1.33
MM	2	insufficient data	1.69
MMFR	2	insufficient data	1.44
MMFA	13	1.36	1.79
MMFN	31	0.98	2.14
MM3	34	1.72	1.87
MM2	27	1.36	1.70
MM1	16	1.19	1.95
MMC	11	1.19	1.53
BT	2	insufficient data	1.69
BTFR	10	11.0*	0.91
BTFA	16	1.52	1.62
BTFN	29	1.97	1.69
BT3	25	1.25	1.93
BT2	22	1.58	1.61
BT1	13	0.65	1.74
BTC	8	1.46	1.28

* Statistically significant variation at 1% level of significance.

if one ship were sampled several times rather than if 12 different ships were sampled only once.

2. The amount of time assigned to individual locations varies significantly from ship to ship for a given personnel grade. This is due primarily to random sampling errors and partly to inherent differences in the operation of each ship.

3. Within a given personnel grade on a particular ship there is a significant variability in both

   a) the locations assigned, and

   b) the amount of time assigned to each location.

4. The large variability associated with items 2 and 3 above suggests that we should expect equally large variabilities in the personnel noise exposure results.

4.2.3 Dosimeter Data

Dosimeter data were collected on six of the twelve sample ships at the same time as noise level and personnel assignment data.

Of interest is the variability of the dosimeter data for the same personnel grade:

a) among the six ships

b) among personnel on the same ship

Data were collected for 48 personnel on the following ships:

FF-1094, USS Pharris
FF-1085, USS Beary
FF-1092, USS Hart
FF-1052, USS Aylwin
FF-1097, USS Moinester
FF-1075, USS Trippe

The threshold below which sound energy or noise exposure was not accumulated was set on the dosimeters to 90 dBA for all ships except the USS Moinester where it was set to 80 dBA. The exchange rate between energy and time was set to 5 dBA for the 90 dBA threshold data and 4 dBA for the 80 dBA threshold data. Due to this variability, all the noise exposures measured using dosimeters were converted to equivalent sound levels. This allowed easy comparisons among dosimeter results and between dosimeter results and equivalent sound levels calculated using measured sound level data and location assignments for each individual.

The relationship between daily noise dose (DND) and equivalent sound level (Leq) is:

$$DND = 10^{(L_{eq}-90)/16.61} = 2^{(L_{eq}-90)/5} \qquad (4.3)$$

The first step in the statistical evaluations is to determine whether there is a significant variation in the equivalent sound level exposure of each grade of personnel from one ship to the next. The appropriate approach here is an analysis of variance test of the measurements among various ships, but the data in Table 4-5 are adequate to perform such a test for only one grade of personnel, namely, BT3.

Table 4-5. Equivalent Sound Levels from Dosimeter Data

Grade	Individual	Equivalent Sound Level in DBA by Ship					
		FF1094	FF1085	FF1092	FF1052	FF1097	FF1075
BTFN	1	93.3		98.3			91.3
	2	96.0					84.8
	3	96.3					
	4	92.4					
	5	88.8					
	6	92.2					
BTFA	1	88.2	84.3				84.8
	2	86.1					
BT2	1	87.1					87.2
	2						78.0
BT3	1	91.6	85.5	82.8	92.0	90.0	86.6
	2		84.1		90.4	93.0	87.5
	3		80.8		91.1	95.0	
	4		89.7			91.0	
MMFN	1			94.8		95.0	90.6
	2			91.1			84.0
	3						90.1
MM3	1				88.1		94.7
	2				87.6		
	3				88.4		
BTFR	1	97.9					
	2	85.1					
BT1	1		86.1				
MMFR	1			92.4			
MMFA	1			88.2		81.3	
FN	1					95.0	

An analysis of variance test was performed on the data for grade BT3 in Table 1 using conventional procedures [2] with the following results:

$$F_{comp} = 6.66$$

$$F_{0.01} = 6.99$$

In summary, the computed F value for variations from one ship to the next falls just below the 99 percentile of the appropriate F distributions. Hence, a hypothesis of homogeneity would be accepted at the 1% level of significance; that is, the variation in the dosimeter data from ship to ship can be explained by random sampling errors instead of being due to inherent differences in the operation of each ship.

The analysis of variance studies for the BT3 data show that the standard deviation of the error (with the small variability among ships removed) is estimated to be 2.5 dBA. If the variability among ships is considered to be insignificant for the other grades as well, then the average standard deviation of all the measurements for each grade is given in Table 4-6. The average over all grades is s = 3.9 dBA.

Table 4-6. Standard Deviations of Equivalent Sound Levels

Grade	Sample Size	Standard Deviation (dBA)
BTFN	9	4.40
BTFA	4	1.74
BT2	3	5.28
BT3	15	4.04
MMFN	6	4.01
MM3	4	3.35

We may draw the following conclusions for the dosimeter data:

1. The scatter in the results for a given personnel grade is large (see Table 4-6) and can be attributed mainly to random sampling error and only slightly to inherent differences among ships.

2. The variation in the data among personnel in the same grade is due primarily to differences in location assignments when the ship is in the auxiliary steaming condition. Some of the variability is also attributable to random sampling error.

4.3 Noise Exposure Results

The personnel location assignment data were used together with noise level data to compute noise exposures in terms of daily noise doses (DND) and equivalent sound levels (Leq) using the following equations:

$$\mathrm{DND} = \frac{C_1}{T_1} + \frac{C_2}{T_2} + \ldots + \frac{C_N}{T_N} \tag{4.4}$$

$$T_j = 8/2^{(L_j - 90)} \tag{4.5}$$

L_j is the noise level at location j
C_j is the time (in hours) spent at location j

$$\mathrm{Leq} = 16.61 \log_{10}(\mathrm{DND}) + 90 \text{ dBA} \tag{4.6}$$

The above equations are based on the OSHA criteria which uses a 90 dBA threshold below which all noise is considered not to contribute to personnel exposure. A DND of 1.0 is an exposure of 90 dBA for eight hours per day. The OSHA criteria also calls for a 5 dBA energy exchange; that is if the sound level is

increased to 95 dBA then a DND of 2.0 will be accumulated for an eight-hour exposure and a DND of 1.0 for a 4-hour exposure. When personnel are exposed to different sound levels for differing amounts of time the daily noise dose is calculated using equations 4.4 and 4.5 and the equivalent sound level (Leq) is calculated using equation 4.6. The equivalent sound level is the continuous eight-hour noise level which would produce the daily noise dose calculated using equations 4.4 and 4.5.

When equations 4.4 through 4.6 were used with the available data to calculate noise exposures, the results obtained were practically useless because almost no one was ever exposed to noise levels in excess of 90 dBA, resulting in DNDs of zero. For this reason the threshold below which noise is not considered to contribute to exposure was lowered from 90 dBA to 80 dBA (which is specified in the most recent Navy regulation). The remaining parts of the OSHA criterion were left unchanged; that is a DND of 1.0 is equivalent to eight hours exposure to 90 dBA and the exchange rate between energy and time is 5 dBA.

Lowering of the threshold also meant that the results were not as sensitive to small errors in sound level measurements, as most sound level measurements were above the 80 dBA threshold.

For daily noise doses of zero (when an individual spends his entire workday in a noise environment below the threshold of 80 dBA) the equivalent sound level is undefined and is represented in the tables and appendices to follow by asterisks.

Using the 80 dBA threshold, the personnel assignment data and location noise level data, daily noise doses and equivalent sound levels were calculated on both individual, grade average and ship average bases. Results were also calculated for the above three cases using area average and sub-area average noise levels as well as individual noise levels. The purpose of these

various calculations, which involved different averaging methods, was threefold: to establish which method provided best agreement with the dosimeter data; to determine whether or not it was necessary to consider personnel on an individual basis or even a grade average basis; and to evaluate the effect of using space average noise levels rather than individual measurements for each specified work location.

4.3.1 Personnel Noise Exposure Results using Individual Location Noise Data

The exposure results included here were calculated with no area averaging of the sound level data.

4.3.1.1 Individual Personnel Exposure Results

Daily noise doses and equivalent sound levels were calculated for each individual surveyed on all 12 ships, using individual location noise data. The data are included in Appendix E and personnel with daily noise doses greater than one are listed in Table 4-7.

The table shows considerable scatter in the data. This is to be expected from the considerable scatter in the personnel assignment data discussed in the previous section. Out of a sample size of 385, 49 were found to be overexposed, 8 had an exposure in excess of 200%, and the highest exposure was 428%.

4.3.1.2 Personnel Noise Exposure Averaged by Grade

The individual personnel noise exposure data were averaged to obtain grade averages for each personnel grade on each ship; the results are included in Appendix F. Equivalent sound levels which are undefined (corresponding to a DND of zero) are not included in the ESL averages; however, DNDs of zero are included

Table 4-7. Individual Personnel Daily Noise Doses Greater than 1.0 Using Sound Levels at Individual Locations

Personnel Grade	FF-1083	FF-1065	FF-1084	FF-1090	FF-1091	FF-1097	FF-1094	FF-1085	FF-1092	FF-1081	FF-1097	FF-1075
ENS								1.31*				
LT				1.65*								
ENFN												
EN3			2.44* 2.11					1.81*				
EN1			4.28*					3.27*				
EM1												
FA												
MMFA									1.63*			
MMFN		1.87 1.13*			1.31			1.79				
MM3		1.48 1.08		1.52 1.09*		1.15			1.42			1.14*
MM2		1.24			1.23 1.31*			3.92* 1.01				
MM1	1.21	1.61										
MML											1.01*	
BTFR							1.15					
BTFA												1.07*
BTFN		1.29			1.19	1.10 2.14* 1.68	1.21			1.39 1.41*		1.14
BT3		1.48				1.32 1.05* 1.10		1.08			1.61 1.35	
BT2	1.16									1.91*		
BT1						2.23*						
BTC						2.36*						

* = grade average noise dose greater than 1.0

in the DND averages. Also, the DND averages represent a logarithmic average of the measured data whereas the ESL averages represent an arithmetic average; thus a one to one correspondence between the two averages should not be expected. Grades with average noise exposures in excess of 100% are marked with an asterisk in Table 4-7.

4.3.2 Personnel Noise Exposure Results using Individual Location Noise Data Averaged over the 12 Sample Ships for Each Location

For these results, all noise level measurements for a particular location in each of the 12 ships were averaged. These average noise levels were then used with the personnel assignment data to calculate both individual and grade average noise exposure results. The grade average results are included in Table 4-8 and the individual results are contained in Appendix G. As there is considerable scatter in the data from one sample ship to another, no one sample ship can be used to represent the class; thus these ship averaged results are useful for the purpose of estimating likely average noise exposures for personnel working on this class of ship in the auxiliary steaming condition.

4.3.3 Personnel Noise Exposure Results using Sub-Area Averages for the Noise Level Data

For the results in this section, noise levels measured at individual locations in the same sub-area were averaged on an energy basis (rather than a dBA basis). The energy basis was chosen as it gives results similar to those which would be obtained if the averaging were done on site using a sound level meter. These average levels were then used together with the personnel assignment data to calculate noise exposures. The sub-areas used and the individual locations included in each sub-area are listed in Table 4-9.

Table 4-8. Grade Average Personnel Noise Exposure and Impact for all 12 Ships: Sound Levels Averaged at Individual Locations over all 12 Ships

Threshold Level = 80.0 dBA
8-Hr Permissible Level = 90.0 dBA
Exchange Rate = 5 dBA

Grade Code	Grade Description	No. of Pers.	Sound Level Mean	Sound Level S.D.	Daily Noise Dose Mean	Daily Noise Dose S.D.
506	ENFN	2	98.6	0.0	1.65	2.34
503	EN1	5	90.5	5.5	1.28	.68
505	EN3	7	91.3	2.7	1.27	.48
302	FA	3	90.2	9.8	1.02	1.44
403	EM1	3	87.5	7.4	.98	.92
402	EMC	1	88.9	0.0	.85	0.00
208	MMFR	1	88.7	0.0	.84	0.00
107	BTFA	19	87.5	5.6	.81	.44
106	BTFN	52	87.7	4.7	.79	.42
108	BTFR	5	86.7	5.5	.77	.42
105	BT3	45	86.9	4.6	.68	.51
207	MMFA	13	85.6	4.1	.63	.34
203	MM1	10	84.7	6.9	.60	.55
206	MMFN	40	84.6	6.0	.60	.38
204	MM2	26	85.9	4.4	.59	.41
205	MM3	53	85.5	3.6	.57	.30
202	MMC	5	85.9	4.7	.54	.55
209	MM	2	85.1	1.5	.51	.11
104	BT2	24	85.5	4.3	.47	.43
603	ENS	5	82.5	4.7	.40	.18
102	BTC	7	83.5	7.3	.40	.45
103	BT1	12	82.2	5.6	.40	.31
301	FN	9	81.8	5.2	.37	.17
504	EN2	1	82.9	0.0	.37	0.00
406	EMFN	3	84.0	2.0	.30	.27
404	EM2	4	80.1	4.6	.29	.19
601	LT	6	77.5	9.7	.29	.42
303	FR	2	79.8	4.8	.27	.17
602	LTJG	8	78.1	5.7	.25	.21
109	BT	2	85.1	0.0	.25	.36
405	EM3	6	80.2	3.2	.23	.16
101	BTCM	1	77.1	0.0	.17	0.00
407	EMFA	1	73.9	0.0	.11	0.00
210	MMCS	1	72.9	0.0	.09	0.00
604	LDCR	1	****	***	.00	0.00
ALL PERSONNEL		385	85.5	5.0	0.62	0.45

Table 4-9 Sub-Areas used for Noise Level Averages

Sub-Area	Locations Included
ELT-Eng. Room, Lower Level	EL1B, EL2B, EL3, EL4, EL5, EL6, EL7
EUT-Eng. Room, Upper Level	EU1W, EU2B, EU3, EU4, EU5, EU6, EU7, EU8
EST-Eng. Room, Second Deck	ES1W, ES2, ES3, ES4
FLT-Fire Room, Lower Level	FL1W, FL2B, FL3B, FL4, FL5, FL6, FL7, FL8, FL9, FL10
FUT-Fire Room, Upper Level	FU1W, FU2W, FU3B, FU4, FU5, FU6, FU7,FU8, FU9, FU10
FST-Fire Room, Second Deck	FS1, FS2, FS3
ALT-Aux. Room 1, Lower Level	AL1, AL2, AL3, AL4, AL5, AL6, AL7
AUT-Aux. Room 1, Upper Level	AU1B, AU2B, AU3, AU4, AU5, AU6, AU7, AU8
XRT-Aux. Room 2	X1W, X2, X3, X4W, X5, X6
FAT-FDB Room 1A	FA1, FA2, FA3
FBT-FDB Room 1B	FB1, FB2, FB3
ST-After Steering	S1W, S2B, S3, S4

The purpose of calculating noise exposures with space-averaged noise levels was to determine whether specifying sub-areas or general areas rather than exact locations for personnel assignments gives noise exposure results which are just as accurate.

4.3.3.1 Individual Personnel Exposure Results

Daily noise doses and equivalent sound levels were calculated for each individual surveyed on all 12 ships, using sub-area space-average noise levels; that is, personnel assignments for locations in the same sub-area were allocated the same noise levels. The data are included in Appendix H and personnel with daily noise doses greater than one are listed in Table 4-10. It is clear that there is still a large amount of scatter in the the personnel grades which are overexposed; however, the amount of overexposure is reasonably consistent, with daily noise doses between 1 and 2 for 74 out of the 89 personnel overexposed and between 2 and 4 for the remainder.

4.3.3.2 Grade Average Personnel Exposure Results

The individual personnel noise exposure data calculated in 4.3.3.1 above were averaged for each personnel grade on each ship. The detailed results are included in Appendix I. Grades with average daily noise doses in excess of 1.0 are marked with an asterisk in Table 4-10.

4.3.4 Personnel Noise Exposure Results Using Noise Data Averaged over Sub-Areas and all 12 Ships

For these results, noise level measurements in particular sub-areas (see Table 4-9) in all 12 ships were averaged and then used with the personnel work assignment data to calculate individual personnel noise exposures which are included in Appendix J. The individual results for each grade of personnel were then averaged to obtain the grade averages which are listed in Table 4-11.

Table 4-10. Individual Personnel Daily Noise Doses Greater than 1.0, Sound Levels averaged over Sub-Areas

Personnel Grade	FF-1083	FF-1065	FF-1084	FF-1090	FF-1091	FF-1097	FF-1094	FF-1085	FF-1092	FF-1081	FF-1097	FF-1075
ENS								1.31		1.03		
LT				1.65*						1.13*		
ENFN								2.94*				
EN3			1.95 2.34*					4.09*				
EN1			3.52*					3.27*				
EN2			1.16*									
EMFN								2.61*				
FA								2.61*				
MMFA									1.6*			
MMFN		1.87* 1.13			1.12			1.08	1.07			
MM3		1.48		1.09 1.52*		1.15		1.32 1.38*	1.03 1.42			
MM2		1.21						3.92 1.60				
MM1	1.02	1.30										
MMC					1.16*			1.53*			1.01*	
BT								1.12				
BTFR							1.02 1.05*					
BTFA	1.04					1.89*		1.12*				1.07*
BTFN					1.19	1.10 2.34* 1.68 1.08	1.03 1.02			1.29* 1.41	1.02 1.02	
BT3		1.44 1.19				1.12 2.04 1.61	1.01 1.01	2.86 1.36* 1.12 1.97		1.35 1.04* 1.06 1.04 [illegible]	1.19 1.15 1.23 1.23	1.07
BT2	1.37					1.06* 1.12	1.03		1.22	[illegible]	1.75 1.24*	1.07
BT1						2.23*	1.02	1.09				
BTC						2.36*						

* = grade average noise dose greater than 1.0

Table 4-11. Personnel Noise Exposure and Impact Grade Averages for all 12 Ships: Sound Levels Averaged over Sub-Areas and All 12 Ships

Threshold Level = 80.0 dBA
8-Hr Permissible Level = 90.0 dBA
Exchange Rate = 5 dBA

Grade Code	Grade Description	No. of Pers.	Sound Level Mean	Sound Level S.D.	Daily Noise Dose Mean	Daily Noise Dose S.D.
506	ENFN	2	94.4	4.6	2.02	1.20
505	EN3	7	93.2	3.2	1.71	.84
503	EN1	5	93.0	1.9	1.55	.40
302	FA	3	89.3	6.6	1.16	.88
104	BT2	24	89.8	3.6	1.08	.46
108	BTFR	5	88.3	6.8	1.03	.65
403	EM1	3	87.5	7.4	.98	.92
105	BT3	45	89.0	3.6	.97	.45
107	BTFA	19	88.2	5.4	.93	.43
106	BTFN	52	87.8	5.0	.87	.39
402	EMC	1	88.9	0.0	.85	0.00
202	MMC	5	87.6	5.1	.85	.50
208	MMFR	1	88.7	0.0	.84	0.00
103	BT1	12	87.4	5.5	.83	.38
101	BTCM	1	88.0	0.0	.75	0.00
203	MM1	10	87.1	3.4	.73	.30
102	BTC	7	85.4	7.5	.73	.46
210	MMCS	1	87.4	0.0	.70	0.00
205	MM3	53	86.2	3.6	.66	.34
406	EMFN	3	86.1	3.9	.64	.36
206	MMFN	40	85.5	4.8	.64	.37
204	MM2	26	84.8	5.8	.62	.37
109	BT	2	86.3	1.6	.61	.13
603	ENS	5	86.0	1.9	.59	.16
207	MMFA	13	85.2	4.0	.59	.31
301	FN	9	82.9	5.9	.47	.27
209	MM	2	84.4	1.6	.46	.10
601	LT	6	79.7	10.0	.45	.46
404	EM2	4	83.2	4.4	.44	.22
504	EN2	1	81.9	0.0	.33	0.00
602	LTJG	8	78.3	5.8	.26	.22
405	EM3	6	79.0	5.1	.26	.15
303	FR	2	78.4	2.8	.21	.08
407	EMFA	1	74.1	0.0	.21	.08
604	LDCR	1	****	****	.00	0.00
ALL PERSONNEL		385	86.5	4.7	0.78	0.41

4.3.5 Personnel Noise Exposure Results Using General Area Averages for the Noise Level Data

For the exposure results discussed here, the noise level data measured in individual locations and sub-areas located in the same general area were averaged on an energy basis. The general areas used and the individual locations and sub-areas included in each are listed in Table 4-12.

Table 4-12 General Areas Used for Noise Level Averages

General Area	Locations Included
ERT-Engine Room	EL1B, EL2B, EL3, EL4, EL5, EL6, EL7, EU1W, EU2B, EU3, EU4, EU5, EU6, EU7, EU8, ES1W ES2, ES3, ES4, ELT, EUT, EST
FRT-Fire Room	FL1W, FL2B, FL3B, FL4, FL5, FL6, FL7, FL8, FL9, FL10, FU1W, FU2W, WU3B, FU4, FU5, FU6, FU7, FU8, FU9, FU10, FS1, FS2, FS3, FLT, FUT, FST
ART-Aux.Room 1	AL1, AL2, AL3, AL4, AL5,AL6, AL7, AU2B, AU3, AU4, AU5, AU6, AU7, AU8, ALT, AUT
XRT-Aux.Room 2	X1W, X2, X3, X4W, X5, X6
FABT-FDB Room 1A/1B	FA1, FA2, FA3, FB1, FB2, FB3, FAT, FBT
ST-After Steering	S1W, S2B, S3, S4

4.3.5.1 Individual Personnel Exposure Results

Daily noise doses and equivalent sound levels were calculated for each individual surveyed on all twelve ships, using general area space average noise levels; that is, personnel assignments for locations in the same general area were allocated the same noise levels which were determined by energy averaging all the individual measurements in that area. The data are included in Appendix K and personnel with daily noise doses in excess of one are listed in Table 4-13. There is still a large amount of scatter in the data from ship to ship and among personnel in the same grade. Out of the 99 personnel overexposed, 80 have daily noise doses between one and two and the remainder have DNDs between 2 and 4.

4.3.5.2 Grade Average Personnel Exposure Results

The individual noise exposure data calculated in 4.3.5.1 above were averaged for each personnel grade on each ship. The detailed results are included in Appendix L. Grades with average daily noise doses in excess of 1.0 are marked with an asterisk in Table 4-13.

4.3.6 Personnel Noise Exposure Results Using Noise Levels Averaged over General Areas and All 12 Ships

For these results, noise level measurements in particular general areas (see Table 4-12) in all twelve sample ships were averaged and then used together with the personnel work assignment data to calculate individual noise exposures which are included in Appendix M. The individual noise exposure results for each grade of personnel were then averaged to obtain the grade averages which are listed in Table 4-14.

Table 4-13. Individual Personnel Daily Noise Doses Greater than 1.0, Sound Levels Averaged Over General Areas

Personnel Grade	FF-1083	FF-1065	FF-1084	FF-1090	FF-1091	FF-1097	FF-1094	FF-1085	FF-1092	FF-1081	FF-1097	FF-1075
ENS								1.31 *		1.03		
LT				1.65 *						1.13 *		
ENFN								2.94 *				
EN3			1.95 * 2.34					4.12 *				
EN1			3.52 *					3.27 *				
EM2			1.13 *									
EM1												
EMFN								2.61 *				
FA								2.61 *				
MMFA								1.23 *	2.02 *			
MMFN		1.7 * 1.13						1.21	1.23	1.34		
MM3		1.13 1.13 1.21		1.52 *			1.03	1.63 * 1.84	1.03 1.42 * 1.42			1.18 *
MM2		1.26 * 1.64						3.92 2.15				
MM1	1.13	1.95 1.09 *			1.09 *					1.04 *		
MMC					1.16 *			1.64 *			1.01 *	
BT								1.12 * 1.12				
BTFR							1.01 1.01 * 1.01					
BTFA						1.99 *		1.12 *				1.07 *
BTFN						1.06 2.23 * 1.62	1.01 1.01 1.01 1.01 1.01			1.22 * 1.41	1.02 1.09 1.02	1.07
BT3		1.14 1.42				2.23 1.87 * 1.99 1.64	1.01 1.01 1.01	2.9 1.5 1.12 * 1.12 2.01		1.13 *	1.31 1.21 1.28 1.28	1.07
BT2	1.08					1.06	1.01		1.22	1.69 *	1.75 1.24*	1.07
BT1						2.23 *	1.01	1.36 *				
BTC						2.23 *						

* = grade average noise dose greater than 1.0

Table 4-14. Personnel Noise Exposure and Impact Grade Averages for all 12 Ships: Sound Levels Averaged over General Areas and All 12 Ships

Threshold Level = 80.0 dBA
8-Hr Permissible Level = 90.0 dBA
Exchange Rate = 5 dBA

Grade Code	Grade Description	No. of Pers.	Sound Level Mean	Sound Level S.D.	Daily Noise Dose Mean	Daily Noise Dose S.D.
506	ENFN	2	94.4	4.6	2.02	1.20
505	EN3	7	93.2	3.2	1.71	.84
503	EN1	5	93.0	1.9	1.55	.40
302	FA	3	89.6	6.2	1.17	.86
104	BT2	24	89.5	3.6	1.04	.46
403	EM1	3	87.7	7.4	1.00	.91
105	BT3	45	89.3	3.5	.99	.41
108	BTFR	5	87.5	7.4	.96	.61
106	BTFN	52	88.3	5.2	.94	.43
208	MMFR	1	89.2	0.0	.90	0.00
107	BTFA	19	87.7	5.8	.89	.42
203	MM1	10	88.3	3.6	.87	.39
202	MMC	5	87.7	5.1	.87	.50
402	EMC	1	88.9	0.0	.85	0.00
103	BTI	12	87.6	5.6	.85	.36
101	BTCM	1	88.5	0.0	.82	0.00
205	MM3	53	86.9	3.6	.73	.35
204	MM2	26	86.0	5.2	.70	.42
210	MMCS	1	87.4	0.0	.70	0.00
109	BT	2	87.4	0.0	.70	0.00
206	MMFN	40	86.0	4.9	.69	.39
102	BTC	7	85.1	7.3	.69	.43
207	MMFA	13	86.1	4.1	.66	.35
406	EMFN	3	86.2	3.6	.64	.35
603	ENS	5	86.3	1.5	.61	.14
209	MM	2	85.7	1.9	.56	.15
301	FN	9	83.3	6.1	.49	.27
601	LT	6	79.9	10.1	.46	.46
404	EM2	4	83.7	3.4	.45	.19
504	EN2	1	81.9	0.0	.33	0.00
405	EM3	6	79.3	5.4	.28	.17
602	LTJG	8	78.5	5.5	.26	.22
303	FR	2	78.9	3.5	.23	.11
407	EMFA	1	74.1	0.0	.11	0.00
604	LDCR	1	64.1	0.0	.03	0.00
ALL PERSONNEL		385	87.0	4.4	0.82	0.41

4.4 Summary of Noise Exposure Results

The variability in the personnel noise exposure results among personnel in the same grade and among ships is dependent upon the variability in both the sound level data and the personnel assignment data. The variability in both of these quantities has been discussed in detail in preceding sections and was found to be relatively large. The personnel noise exposure results are affected more by the variability in personnel assignment data than by the variability in noise level data. As expected, the large variability in the personnel assignment data leads to a similarly large variability in the noise exposure data among personnel in the same grade on the same ship and also among different ships.

To begin with, noise exposures were calculated for each individual sampled on each ship, using specific noise data for each assigned location. The results showed a considerable amount of scatter both among ships and among personnel in the same grade on any given ship. To obtain results which may be used to characterize this type of ship in the auxillary steaming condition, the equivalent sound level results for all 12 ships were averaged arithmetically for each personnel grade. Additional personnel exposure and equivalent sound level calculations were performed using both sub area average and area average noise levels (obtained by averaging noise level data over specified locations in each area). The purpose of these calculations was to determine whether or not the variance in the exposure results would be reduced and whether or not better agreement would be obtained with the dosimeter data. This latter subject is addressed more fully in the next section.

The preceding results showed that sub-area and general area averaging of the noise levels prior to the exposure calculations reduced slightly the overall standard deviation of the personnel

equivalent noise levels (see Tables 4-8, 4-11 and 4-14). The same tables showed that the mean equivalent noise level for all personnel increased slightly as the noise level averaging became more general. Averaging of noise levels by sub-area had only a slight effect on the rank ordering of the personnel grades by exposure; averaging noise levels by general area had a further slight effect. Grades which were identified as having an average DND in excess of 1.0 when no noise level averaging was used were still identified when the noise levels were area averaged. However, noise level averaging did cause the original number of personnel grades identified as having an average DND in excess of 1 to increase from 4 to 6. The total number of personnel identified as being overexposed when ships and personnel were considered on an individual basis are listed in Table 4-15 below.

Table 4-15 Number of Personnel Overexposed Expressed as a Percentage of the Total Number Surveyed; Individual Basis, No Noise Level Averaging Over Ships.

	No Averaging of Sound Levels	Sub Area Averaging of Sound Levels	General Area Averaging of Sound Levels
DND in excess of 1.0	12.7%	23.1%	25.7%
DND in excess of 2.0	2.1%	2.9%	3.9%
DND in excess of 3.0	0.8%	1.0%	1.0%

The results in Table 4-15 show that averaging of noise levels increases the number of personnel identified as being overexposed when the exposure data are considered on an individual basis.

When the noise level results are averaged over all 12 ships and then used to calculate the noise exposures on an individual basis, the number of personnel identified as being overexposed increases (see Table 4-16 below). Averaging the noise levels by sub area further increases the number of personnel identified as being overexposed; however further averaging of noise levels by general area has an insignificant effect.

Table 4-16 Number of Personnel Overexposed Expressed as a Percentage of the Total Number Surveyed on an Individual Basis -- Location Noise Levels Averaged over all 12 Ships.

	No Averaging of Sound Levels	Sub Area Averaging of Sound Levels	General Area Averaging of Sound Levels
DND in excess of 1.0	17.7%	28.8%	28.1%
DND in excess of 2.0	1.6%	2.3%	2.3%
DND in excess of 3.0	0.3%	0.3%	0.3%

The first question we need to address is: Which of the results more truly reflect the noise exposure problem? Clearly the individual results shown in Table 4-15 are very sensitive to errors in individual personnel assignment data. When area averaging of noise levels is used, errors in individual personnel assignment data become less important. However, area averaging of noise levels can cause errors when noise environments of widely differing noise levels are averaged and are shown to be widely different on a systemmatic basis rather than a random basis. This latter reason is probably responsible for the increase in number of personnel overexposed when area averaging of noise levels is used.

Averaging noise levels for each location over all 12 sample ships provides a more accurate picture of the noise environment to which personnel are exposed on average, provided there are no systemmatic differences between ships -- this was shown to be the case in Section 4.2.1.

The next question which arises is: Should personnel be averaged by grade or would an average over all personnel be preferable?

The ship average by grade results for the case of no area averaging of sound levels are listed in Table 4-8 and show that where more than one sample existed in the same grade, the standard deviation in equivalent sound level for these samples varied from 2.0 to 9.8 dBA, whereas the standard deviation in equivalent sound levels for all personnel was 5 dBA. Referring again to Table 4-8 we note that the range of average equivalent sound level values among different personnel grades with a sample size of at least 10 is only about 5 dBA and only 3 dBA for sample sizes greater than 12. On the other hand the standard deviations for these grades range from 3.6 to 6.9. It follows that the overlap of equivalent sound level values from one grade to another is very large, suggesting that separating personnel into grades for the exposure computations is not worthwhile. Instead, all personnel should be combined together, and average and standard deviations computed for the exposure, at least when the ships are in the auxiliary steaming condition. This would require fewer measurements, for similar accuracy, than if personnel grades are treated separately. Of interest therefore, is the number of sample ships required and the number of personnel which should be sampled on each ship to obtain a given accuracy in the overall mean equivalent sound level, when the ship is in the auxiliary steaming condition.

First of all we will estimate the number of ships which should be sampled to provide ± 1 dBA, ± 2 dBA and ± 3 dBA accuracy for the average equivalent sound level results. One way of assessing the variation from ship to ship is in terms of a coefficient of variation ε, given by

$$\varepsilon = s/x \tag{4.7}$$

where s = standard deviation of the sample values from one ship to another

x = mean value for all ships in the sample.

The coefficients of variation for all three cases for which ESLs were calculated are listed in Table 4-17 below.

Table 4-17. Coefficients of Variation for ESL Values for the Sample Ships

Case Description	Coefficient of Variation
No area averaging of noise level data	0.025
Sub area averaging of noise level data	0.026
General area averaging of noise level data	0.029

The average 90% confidence limits for a given accuracy in results may be approximated by

$$90\%\ CL = x\left(1 \pm t\varepsilon/\sqrt{n}\right) \tag{4.8}$$

where n is the number of sample ships and
t is the value of the 90% point on the student t distribution corresponding to the sample size chosen.

The preceding expression may be used to estimate the number of sample ships required to obtain a ±1 dBA, ±2 dBA and ±3 dBA accuracy in the equivalent sound level estimate. These results are summarized in Table 4-18 below.

Table 4-18. Minimum Number of Ships To Be Sampled for ±3 dBA, ±2 dBA and ±1 dBA Accuracy in the Average ESL Computation.

Case Description	±3 dBA Accuracy	±2 dBA Accuracy	±1 dBA Accuracy
No area averaging of noise level data	3	4	14
Sub area averaging of noise level data	3	5	15
General area averaging of noise level data	4	6	18

A similar calculation may be used to estimate the number of personnel which must be sampled on each ship to obtain a ±3 dBA, ±2 dBA and ±1 dBA accuracy in the average ESL computation. The coefficients of variation ε are calculated using Equation 4.7 for each ship and are listed in Table 4-19. The average value at the bottom of the table is calculated using

$$\varepsilon_{av} = \left[\frac{1}{n}\sum_{i=1}^{n}\varepsilon_i^2\right]^{\frac{1}{2}} \tag{4.9}$$

Equation 4.8 is then used with ε_{av} to calculate with 90% confidence the average number of personnel to be sampled on each ship for a ±1 dBA, ±2 dBA and ±3 dBA accuracy in the average ESL results. The total number of sample personnel required for ±1 dBA, ±2 dBA and ±3 dBA accuracy in the overall average ESL results is approximately equal to the product of the value in Table 4-20 and the corresponding value in Table 4-18.

The results show that sufficient ships and sufficient personnel on each ship were sampled to obtain a ±1.5 dBA accuracy in the overall average equivalent sound level estimate; better results would be obtained by sampling more personnel on each ship and less ships.

Thus we can conclude with 90% confidence that the overall average equivalent sound level estimate of 85.5 dBA is within 1.5 dBA of the true value. However the variation among personnel is large, as indicated by the standard deviation value of 5 dBA for the case of no area averaging of the sound level results. The maximum variation around the mean was measured at ±15 dBA.

Table 4-19. Coefficients of Variation for ESL Values for Personnel in Each of the 12 Sample Ships

Ship Number	No Averaging of Sound Levels	Sub Area Averaging of Sound Levels	General Area Averaging of Sound Levels
FF-1083 USS Cook	0.079	0.060	0.052
FF-1065 USS Stein	0.069	0.054	0.096
FF-1085 USS Candless	0.108	0.083	0.080
FF-1090 USS Ainsworth	0.062	0.052	0.054
FF-1091 USS Miller	0.071	0.047	0.049
FF-1097 USS Moinester	0.079	0.066	0.060
FF-1094 USS Pharris	0.072	0.063	0.063
FF-1085 USS Beary	0.058	0.059	0.057
FF-1092 USS Hart	0.086	0.071	0.192
FF-1081 USS Aylwin	0.043	0.047	0.039
FF-1097 USS Moinester	0.071	0.091	0.060
FF-1075 USS Trippe	0.045	0.029	0.035
OVERALL ε	0.072	0.062	0.081

The preceding statistical analyses were based on equivalent sound levels rather than daily noise doses. However any conclusions can be applied equally well to the daily noise dose data.

Table 4-20. Minimum Number of Personnel To Be Sampled on Each Ship for ±3 dBA, ±2 dBA and ±1 dBA Accuracy in the Average ESL Computation.

Case Description	±3 dBA Accuracy	±2 dBA Accuracy	±1 dBA Accuracy
No area averaging of noise level data	13	26	100
Sub area averaging of noise level data	10	20	74
General area averaging of noise level data	16	34	130

4.5 Comparison of Dosimetry Data with Calculated Noise Exposure Data

The dosimeter data for 37 specific personnel were directly identified with computer calculations of their ESL exposure (the other 12 personnel producing dosimeter data could not be identified with specific calculations because of inadequate records of their locations). Comparisons between the dosimeter data and computer calculated ESL and DND data were then made in the following categories.

1. Using the 37 individuals with directly matched dosimeter data and computer calculations, the differences between the dosimeter and computer equivalent sound levels were calculated using compute. calculations based upon:

   (a) sound levels at individual locations,

   (b) average sound levels on each level of each engineering area (subarea average), and

   (c) average sound levels in each engineering area (general area average)

2. Using the 48 individuals for which dosimeter data are available, the individuals were pooled by grade and the average dosimeter reading for each grade was computed. The differences between the grade averaged dosimeter data and similar computer model averages were calculated using computer calculations based upon:

   (a) sound levels at individual locations on individual ships,

   (b) sound levels at individual locations averaged over all 12 ships,

   (c) average sound levels on each level of each engineering area on individual ships,

   (d) average sound levels on each level of each engineering area averaged over all ships,

   (e) average sound levels in each engineering area on individual ships, and

(f) average sound levels in each engineering area averaged over all ships.

The differences computed in the above comparisons were reduced to a mean and standard deviation by

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i \qquad s = \left[\frac{1}{n-1}\sum_{i=1}^{n}(x_i-\bar{x})^2\right]^{1/2} \qquad (4\text{-}10)$$

where x_i = difference between the dosimeter ESL and the corresponding computer predicted ESL.

The results of the comparison studies are summarized in Table 4-21.

The detailed results are included in Appendix N.

The best agreement between the noise exposure calculations and the dosimeter data is expected when comparisons are made on an individual basis, using noise levels with no area averaging. The data in Table 4-21 shows that this is not so. The main reason for the discrepancies is lack of accuracy in the definition of an individual's location assignments and the amount of time spent in each. This lack of accuracy shows up particularly when an individual spends most of his time in a relatively quiet environment and occasionally spends a small amount of time in a noisy environment. In this case a small error in location assignment is magnified tremendously in the daily noise dose and equivalent sound level results leading to large errors in these quantities. These large errors are particularly apparent in several cases where the discrepancy between the calculated ESL and the dosimeter data exceeds 10 dBA. It is clear in future that personnel need to be questioned more closely to obtain a more accurate picture of their location assignments and times.

One way of reducing the need for accurate location and assignment time data is to average noise levels over sub areas (or levels) or average noise levels over general areas (see Tables 4-9 and 4-12 respectively for locations which are included in each average). As can be seen in Table 4-21 this noise level averaging procedure significantly reduces the average difference between the dosimeter results and the calculated ESL results. However the standard deviation is not significantly reduced, indicating that a similar scatter in the difference on an individual basis still exists. Note that the general area average offers no improvement over the sub area average.

The effect of averaging results over grades before taking the difference between the dosimeter data and calculated ESL data is also shown in Table 4-21. It can be seen that when the results are considered on a ship-by-ship basis the average difference (or error) is smaller than when the data for all 12 sample ships are averaged before taking the difference; however the standard deviation (or scatter in results for individual grades) does not change significantly. The effect of averaging noise levels over sub areas and general areas is also shown in the table for the grade average results. The average error (or difference) decreases as the noise levels are averaged on a broader basis. However the standard deviation (or scatter) in the results does not change significantly.

We may conclude the following for the dosimeter and calculated ESL data comparisons.

1. The differences between the calculated ESL data and dosimeter data are large and may be attributed mainly to errors in both the location assignments and assignment times at each location for individual personnel. When there are large differences in location noise levels, [illegible] these quantities lead to large errors in

Table 4-21. Summary of Equivalent Sound Level Data Comparisons

Grouping of Data			ESL Error Data, dBA		
Personnel	Locations	Ships	Sample Size	Mean Error	Standard Deviation
Individual	Individual	Individual	37	4.0	7.3
	Subarea Average	Individual	37	0.1	5.9
	Area Average	Individual	37	0.7	5.8
Grade Average	Individual	Individual	22	2.1	6.3
		Average	11	5.7	4.2
	Subarea Average	Individual	22	0.8	5.9
		Average	11	2.1	4.5
	Area Average	Individual	22	0.3	5.9
		Average	11	1.9	4.1

the calculated ESL, particularly when an individual spends the majority of his time in a quiet area. Some differences may also be attributable to intermittent noise, such as metal to metal impacts or shouting by the wearer, being accumulated by the dosimeter but not taken into account in the calculated data.

2. Averaging noise levels over sub areas reduces the average difference or mean error but does not reduce the standard deviation or large scatter in the individual differences.

3. Averaging noise levels over general areas rather than sub areas offers no significant improvement.

4. Averaging data for personnel grades or averaging over ships does not improve the results.

5.0 STRUCTURE OF SHIPBOARD NOISE DATA MANAGEMENT SYSTEM

5.1 Summary of Results and Model Limitations

The proposed means of validating the data management system was to compare dosimetry data with noise exposure results calculated from location noise level data and personnel assignment data for Knox Class ships operating in the auxiliary steaming condition. These comparisons were made first of all on an individual basis, with no area averaging of the noise level data for the purposes of calculating the exposures. Most of the discrepancies between the dosimetry data and the calculated data can be attributed to the following factors:

(a) The personnel assignment data were not sufficiently accurate, especially when personnel were assigned to quiet locations for long periods of time and occasionally spent time in noisy locations.

(b) The calculation procedure does not take into account such things as conversation or shouting and possible intermittent banging of tools on hard surfaces.

(c) The dosimeter data may be inaccurate due to the close location of the microphones with respect to the personnel carrying them.

(d) Measured noise levels were very close to the threshold level of 90 dBA below which exposure was not accumulated. Thus small variations in noise level produced large variations in the dosimeter data. This problem was somewhat alleviated for the noise exposure calculations (from the sound level and assignment data) by using an 80 dBA threshold.

In an attempt to reduce the difference error between dosimeter data and calculated ESLs, noise level data were averaged over sub areas or levels (see Table 4-9). This reduced the average difference between dosimeter results and calculated results to an insignificant amount, but the variations on an individual basis were still large, as indicated by the large numbers for the standard deviation in Table 4-19. Further averaging of the noise levels over general areas produced no reduction in the average difference (or error) or the standard deviation.

The choice of the auxiliary steaming condition for validation of the model was not a good one for the following reasons:

(a) Not all personnel were on board ship during the survey times.

(b) Description of duties for personnel within a particular grade or rate varied enormously with no clear cut trends.

(c) Noise levels were close to the 90 dBA threshold level.

(d) It was difficult to find ships in this condition and to schedule noise surveys as explained in Section 3.

An additional problem which led to some confusion during the data collection was the regulation change from the BUMED Instr. 6260.6b criteria to the new DOD Instr. 6055.3 criteria of 80 dBA threshold, an energy-time exchange rate of 4 dBA per halving or doubling of the exposure time and an allowable 8-hour exposure of 84 dBA.

5.2 Recommendations for Further Validations

Due to the problems outlined in the previous section, the auxiliary steaming condition was not suitable for validating the

model. For this reason we suggest a further series of validating measurements, to be made on ships in the underway condition. There are several advantages to doing this as follows:

1. Personnel work assignments are expected to be more uniform on a daily basis and personnel in the same grade are expected to have duties which are more alike.

2. Noise levels will be higher and the threshold level will be 80 dBA, corresponding to the new DOD instruction; this will alleviate the problem of noise levels close to the threshold level which can cause large errors in exposure calculations for small errors in noise level measurement. Also any errors in the dosimeter threshold will become unimportant.

3. It should be easier to obtain the required amount of data in a relatively short time due to the lack of difficulty expected in finding ships in this condition.

4. All personnel are expected to be present on the ship and should be easier for the survey personnel to find.

The results for the auxiliary steaming condition showed that little benefit was gained by separating individuals into grades or rates and some significant benefit was gained by averaging noise levels in the same sub area (see Table 4-9). However, this may not be so when the ship is in the underway condition. Thus, at least during the validation procedure, we recommend keeping personnel separated into grades and no area averaging of noise levels.

5.3 Conclusions and Recommendations

A review of the objectives of this study can be summarized as follows:

1. Data acquisition procedurees, consistent with the requirements of the personnel noise exposure model, were developed.

2. These procedures were successfully adapted to current Navy (EPMU) procedures for noise data collection. It was shown that the medical units not only can accurately collect this type of information but that the time required compares favorably with present procedures.

3. The training and equipment available to the EPMU's is sufficient to permit the new data acquisition techniques to be implemented at all EPMU locations.

4. The accuracy of noise exposure predictions, using the model and the data base collected, is inconclusive. The reasons for the disagreement found are discussed in Section 5.1; the major one being the selection of the "auxiliary steaming" operational mode to validate the model. It is believed that an analysis conducted "underway" on this same class of ships would yield more significant results.

5. The results of the analysis point out that for ship operational conditions where the personnel noise exposure is at or very near to threshold small errors in the "personnel assignment" data parameter may result in large prediction errors. The methodology of how this data parameter is collected in the field to increase its accuracy needs to be reviewed so that the accuracy can be improved.

The apparent problem concerning the validity of noise exposure data management system and indicated by the preceding results is that personnel noise exposure may not be calculated accurately for some ship operating modes, i.e. auxiliary steaming. This conclusion may be modified, to some extent, if the corrective actions discussed under Item 5 are developed and implemented.

However, it should be noted that the noise problem for this condition was limited to only 2.6% of the personnel surveyed when the mean noise dose is considered (see Tables 4.8, 4.11 and 4.14). Thus, the importance of this operational mode to the yearly individual noise exposure (when the exposure and time spent for all other operational modes is included) most probably will not be very substantial. It should be noted that this conclusion may not be true for all ship classes.

Finally, the preceding results and analysis showed that the personnel grade description was inconsequential to the noise exposure picture. That is, no specific personnel grade could be identified as being more exposed to noise than another (rank-ordering of grades by exposure). The ability to distinguish among grades is believed to be important in comparison with audiometric data as part of the general objectives of the data management system. The inability to distinguish among grades in terms of noise exposure in the preceding analysis is attributable to the use for a data base of the auxiliary steaming condition where only a small percentage of personnel are overexposed. This result is not expected to be representative of the average conditions on board ship, as Reference 1 shows that a large percentage of engineering personnel are overexposed on a yearly basis.

It is believed that the evaluation of the underway operational mode will not only result in substantially higher percentages of personnel being overexposed (and to a larger degree) but also in a more structured work pattern where grade rankordering according to exposure will be identified.

6.0 REFERENCES

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This study is concerned with the development and validation of a shipboard noise exposure data acquisition procedure. This procedure represents a first step in the overall framework for a Navy Noise Exposure Data Management System which is discussed in the text. The immediate purpose of this data collection process is to provide for standardized measurement techniques that may be used by various Navy units concerned with occupational noise and hearing conservation. This noise data base, when computer-

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20. ized, can be used in concert with the shipboard noise exposure model developed in an earlier study [1] to assess the magnitude of the overexposure problem on individual ships, ship classes and ultimately the entire fleet. The benefits of this approach are guidance in the development of hearing conservation and educational programs, and in the assessment of noise control priorities in the fleet. Future extensions of the data management system include:

1. The assessment of audiometric data together with the noise exposure data as a function of personnel rates and,
2. Extension of the system capabilities to other occupational hazards such as heat stress.

The results of this study, which was conducted on 12 ships of the FF-1052 (Knox) Class, showed that standardized measurement techniques consistent with the requirements of the data base can be successfully collected by Navy personnel (Environmental Preventative Medical Units). Both the time required to perform each survey and the quality of the data collected by the EPMUs meet with the original goals of the study.

The validation of the data base was conducted based on the analysis of the "auxiliary steaming" operational mode of 12 ships. Noise exposures for various engineering rates were computed using the analytic model and compared with an independent data set collected using dosimetry. The results of direct comparisons show substantial discrepancies. These are due mostly to a lack of consistent definition in the personnel assignment data and the proximity of the calculated noise exposures to the threshold established by the BUMED noise standard. In retrospect, the selection of the "Auxiliary steaming" operational mode was unfortunate in the validation effort. It is believed that comparisons for an "underway" operational mode would yield significantly more consistent results.

It is recommended that a limited validation of the "underway" mode be conducted. Furthermore, it is recommended that the data base be computerized, at least for the FF-1052 (Knox) Class and that all EPMUs utilize the data acquisition procedures when surveying this class.

APPENDIX A

THE OCCUPATIONAL NOISE EXPOSURE & ASSESSMENT MODEL

This appendix contains the outline of the noise exposure and assessment model developed in Reference [1]. It is presented here for completeness and as a reference to the additional utility of the data base in addition to the computation of personnel noise exposure.

APPENDIX A

A. OCCUPATIONAL NOISE EXPOSURE AND ITS CONTROL -- AN ASSESSMENT MODEL

This chapter presents a discussion of the data base requirements and the sequential steps necessary to evaluate and quantify the noise exposure problem on board surface vessels. The assessment model also explores the acoustic data base and steps necessary to evaluate the noise reduction requirements for equipment in order to meet a specific procedure that may be used to evaluate the state-of-the-art in noise control technology on board ships and the costs associated with the implementation of this technology.

The intent was to develop a model, general enough to evaluate the noise exposure problem on any ship class in the U. S. Navy, and to provide a sequential procedure for the assessment of the noise control alternatives and costs. The parametric organization of the data base allows for a quick evaluation of personnel noise exposure problem in the face of present as well as any future standard. The data base also has the flexibility to be easily expanded by the addition of more information as it becomes available to the Navy, thus providing for a more accurate assessment.

A.1 A Model for Noise Exposure Evaluation

This section presents an overview of the general model that will be used to compute the noise exposure problem in shipboard spaces and will discuss the data base requirements necessary to utilize the model.

The need for a model stems from the fact that personnel noise exposure is a quantity which requires the understanding of

several variables; not all of which are noise oriented. For example, since noise exposure is a time weighted quantity (according to DOD/BUMED), it is necessary to know not only the given noise level at a given location but also how that level changes as a function of the ship's operational characteristics. Furthermore, since personnel noise expousre is time and location dependent, it is necessary to obtain a relationship between crew time and location assignments and the noise levels generated by the different ship conditions.

The data base requirements for a personnel noise exposure evaluation are as follows:

(1) Ship operational characteristics
(2) Personnel work assignments
(3) Airborne noise data

The following discussion explores these parameters in terms of the model and shows they interact for the computation of noise exposure.

A.1.1 Ship Operational Characteristics

Occupational noise criteria are based on the assumption that exposure levels are repetitive, day in and day out, over long periods of times; for example, a number of years. This condition, of course, does not hold true in the Navy since each ship goes through a number of operational characteristics from cruising conditions to at-dock conditions in the course of a year.

Each one of these operational conditions is characterized by different noise levels, especially in the engineering spaces since the number of on-line pieces of equipment needed under different conditions varies.

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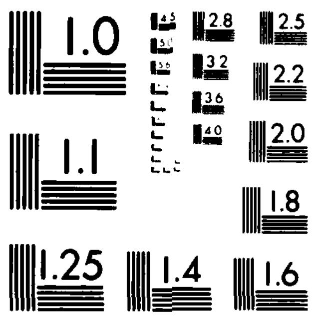

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The objective of the ship class operational characteristic parameter is the definition of operational modes which can be considered constant. This will allow the computation of personnel noise exposures which are unique to a specific ship operational mode. For the purposes of this program we will define an operational mode as a ship condition for which the machinery line-ups in each engineering space and the personnel assignments of the crew can be considered constant. In other words, an operational mode means that the noise level at a specific location is closely related to specific machinery line-up and can be considered constant at that location. Furthermore, it means that the personnel working in the engineering spaces go through typical routines that may be considered nearly constant for that operational mode.

The manner in which naval ships operate varies depending on their mission. In that sense, each vessel proceeds through a number of assignments in the course of a year from at-dock conditions, where the vessel is stationary and only a limited number of equipment is operational, to underway conditions which require it to steam under a variety of speeds. Each speed or range of speeds may be associated, in principle, with the operation of a specific machinery line-up, especially in the propulsion system area. It should be recognized, however, that within a ship's class, the operational characteristics and machinery line-up may vary to some degree.

Since, as was pointed out, noise levels within the engineering spaces vary as a function of machinery line-up (equipment operating for a specific condition), it is necessary to describe the ship operational history as a function of time. Moreover, it is desirable to associate a specific machine line-up with each operational mode. Finally, in order to describe a ship class, it is necessary to evaluate how the operational history and machinery line-up vary within the class. This will permit

an assessment of the variability within the class and, in fact, will allow to determine if a typical operational history can be chosen to describe the class. The preceding discussion leads to the following data base requirements necessary to describe the ship class operational characteristics:

(1) Ship operational history where the amount of time spent at-dock and underway is specified for at least a one-year period.

(2) A definition of the machinery line-up (on the average) when the ship is operating in each of the above two modes. It is expected that more than one machinery line-up may exist within each mode (i.e., cold iron and auxiliary steaming at-dock). This will necessitate the definition of a number of sub-modes, which may be characterized by a specific machinery line-up. For example, when underway, it is conceivable that machinery line-up will have a relationship with speed ranges of the ship.

(3) In order to develop an understanding of the mode or sub-mode variability within a ship class the above parameters are required for more than one ship within the class. The number of vessels required for the class evaluation will depend largely on the variability found from ship to ship so that a statistically valid sample may be examined.

The above data will be used to develop a quantitative description of a ship class operational characteristics. The following relationships will be evaluated and computed:

(1) The definition of a ship's "typical time history year" where the percentage of time spent within each mode or sub-mode is quantified (i.e., 20% of the time at cold

iron, 10% of the time steaming between 10 and 15 knots, etc.).

(2) The definition of the "typical time history year" variability within the class. This will allow to assess the probability of sub-mode occurrence and confidence limits associated with the assumptions for typical operations. Ideally, it is desirable to introduce statistics into the evaluation by computing the mean and the standard deviation for each mode or sub-mode of operation (i.e., the mean time spent at cold iron sub-mode is 20% with a standard deviation of 5%). This approach will allow to judge if "typical ship class operational history" is indeed quantifiable and define the limits associated with the description.

(3) The definition of "typical ship class machinery line-up" within a mode or sub-mode and the variability found in the class. The machinery line-up must be specified separately for each engineering space considered. It is expected that certain variability in this parameter will be found from ship to ship. The definition of the "typical ship class machinery line-up" will be obtained similarly to the "typical time history year" by evaluating the statistics associated with the ship's class operation.

In summary, the operational modes and sub-modes will define the ship operating conditions for which the noise levels in different engineering spaces and the operator assignments in those spaces can be considered <u>constant</u> or are predictable on a twenty-four hour basis. Furthermore, the variability of these operational modes for a specific ship and across ship class will also result from this evaluation.

A.1.2 Noise Exposure Model

A "hazard" can be defined as a physical effect which has an adverse impact on the health or safety of individuals in the work environment. In the case of shipboard environments two typical potential hazards are noise and heat stress. Each one of these hazards will have an adverse effect on the health or safety of personnel if they are exposed to the hazard for extended periods of time or the magnitude of the hazard is excessive.

It might be generalized that many health standards, developed to judge the acceptability of a hazard are written in terms of two parameters: time and magnitude. In other words, an operator may safely withstand a certain level of a hazard for a specified amount of time without adverse effects. In general, the magnitude of the hazard is related to the exposure time to the hazard. The longer the exposure time, the lower the allowable magnitude of the hazard. Time and magnitude, therefore, are the two parameters which specify the permissible exposure to a hazard which, in the judgement of a health standard, is considered permissible.

Let us now address the problem of the data base required to evaluate the magnitude of a hazard on man. In the present case the hazard is <u>excessive noise</u>. As specified in the data base requirements of Section A.1, in addition to ship operational characteristics, the two inputs necessary for the computation of noise exposure are <u>personnel work assignments</u> and <u>airborne noise data</u>. Airborne noise is given by the physical phenomena which can be readily measured in terms of sound pressure level. Associated with the acoustical measurement is the location at which the measurement is acquired. Therefore, the description of the noise hazard can be accomplished by describing two

variables: the magnitude* of the noise and the location at which the noise was measured. The description of the hazard does not require any additional parameters to the magnitude and location and can be considered constant for the same operational mode or sub-mode.

The second requirement of the data base is the description of the personnel work assignments. Since by definition, the word "exposure" implies that an individual is exposed to the hazard, it is necessry to quantify where and for how long this exposure takes place. Therefore, the duty or personnel work assignment input has two variables: time and location.

Figure A.1 depicts the general arrangement of the noise exposure model. The two basic inputs to the calculation of personnel noise exposure; the personnel work assignment or duty in terms of time and location and the noise level, in terms of location and magnitude are identified for each operational mode or sub-mode. The dependent variable in the data base is "location": the magnitude of noise at a specific location and the amount of time the individual spends at the location. The independent variables are of course time and magnitude. Both the BUMED Inst. 6260.6 and the DOD Inst. 6055.5 are formulated in this manner. The former is as follows:

$$T = \frac{16}{2^{(L-80)/4}} \tag{1}$$

where L is the measured noise level at the operation location in dB(A) and is the allowable time of exposure to level L in hours.

* Since most noise standards are written in terms of the A-weighted sound pressure levels (dBA), the magnitude of the noise is the only necessary physical descriptor of the phenomena. Implied in the descriptor is a frequency weighting of the noise spectrum which allows to describe the entire audio frequency range with a single number.

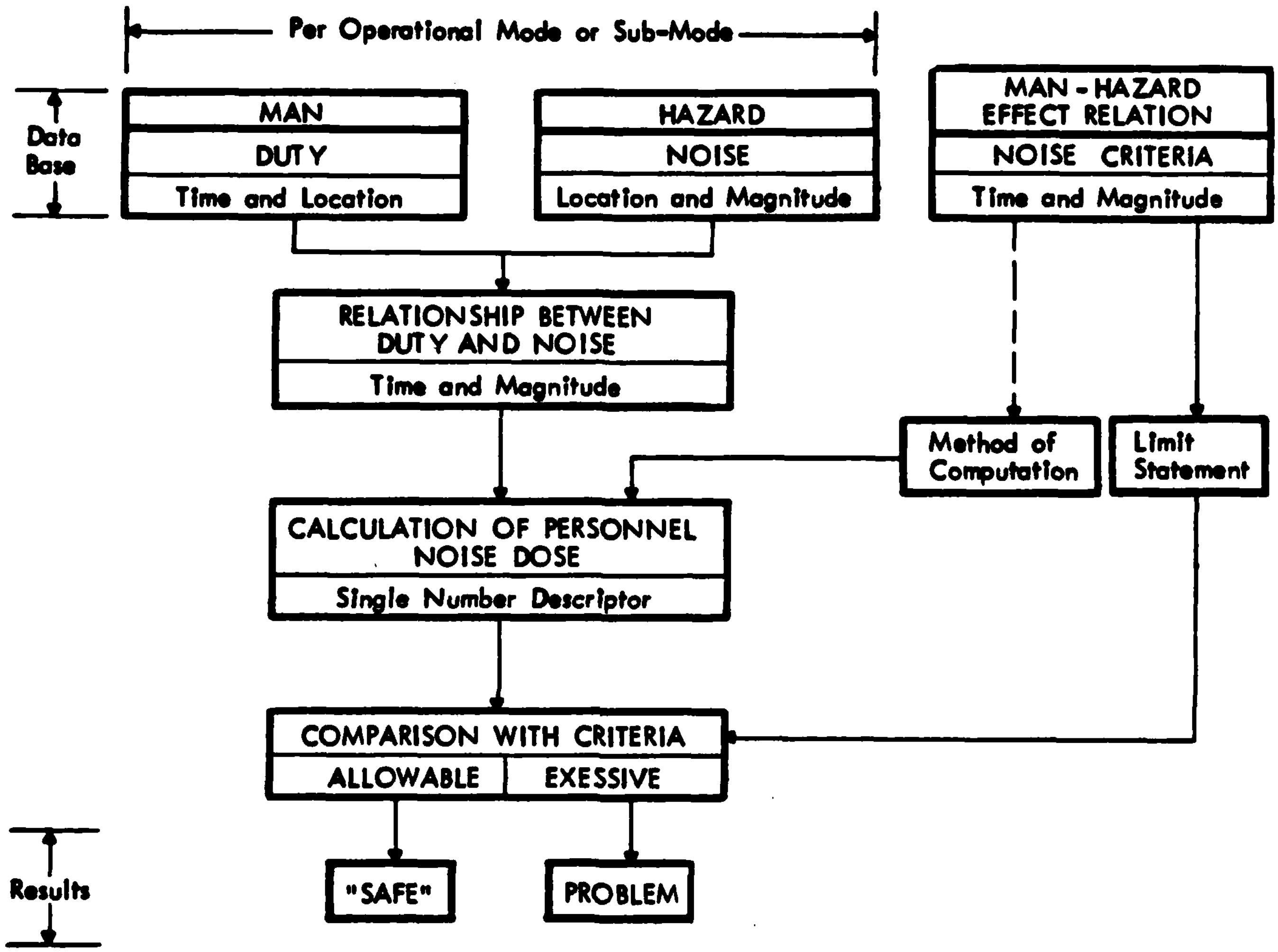


FIGURE A.1 DEFINITION OF NOISE EXPOSURE PROBLEM

The knowledge of these two data inputs allows us to develop the relationship between the duty of the operator and the hazard; this relationship being a function of time and magnitude as follows:

$$I_{ij} = I_{ij}\ f(L_j, C_{ij}) \tag{2}$$

where I_{ij} is the i<u>th</u> individual at the j<u>th</u> location, L_j is the level in dBA at location j and C_{ij} is the time spent (in hours) by the i<u>th</u> individual at location j. The subscript j refers to the number of spatial locations considered from 1 to m and the subscript i refers to the number of individuals being evaluated from 1 to n.

The development of the relationship between duty and noise is the <u>most important</u> and <u>difficult step</u> in the noise exposure problem. Once this relationship has been established, any man-hazard effect standard can be quickly evaluated and computed.

A few notes of interest. In principle, the noise level data base should be given on a point by point basis. Similarly, the data base for the duty or personnel work assignment should be done on an individual by individual basis. In practice, this is not only impossible but under most conditions, not necessary. For example, the spatial description of noise can be associated with an area; the size of the area will depend on the fluctuations in the noise levels and the accuracy required. In some cases, this may mean a quarter of the space in question or even the entire space may be described by a single noise level. In the case of personnel assignment, it is possible to associate duty with a job description or rank which is common to a number of individuals. These groupings will depend on the variability of job assignments, accuracy required and the ability to predict personnel movements over the long term. In deciding on the

above groupings and generalizations, it is important to remember that the model is intended to describe and analyze the noise exposure problem of an entire ship class. In that sense, averaging techniques in the spatial description of noise level and grouping techniques in the description of personnel assignment are not only valid but desirable. This will simplify the extent of the data base requirements provided that statistical techniques are used to describe the mean and variability of each descriptor so that, in the end, a meaningful assessment of the accuracy and confidence limits for the personnel exposure predictions can be made.

Furthermore, it should be noted that once the relationship between duty and noise has been established, the information can be updated and refined by any future new information available about one of the above two descriptors. For example, the personnel work assignment data base for a fireman may be described in terms of the number of hours spend at each different location within the engine room based on the information acquired for the group on two ships. The statistics of the data base will provide the confidence limits for that descriptor. If information on the duty assignment for that group is available later for three or more other ships, the confidence limits for the descriptor will be obviously improved. The same reasoning applies to the description of the spatial noise levels.

The relationship between duty and noise may now be used to calculate the personnel noise exposure dose as outlined in Figure A.1. In the case of the DOD standard, the relationship formulated in Eq. (1) may be used to define the fractional noise dose (f) as follows:

$$f_{ij} = \frac{C_{ij}}{T_{ij}} \tag{3}$$

where T_{ij} is the maximum allowable time (in hours) permissible by the standard at the noise level L_j. The fractional noise dose is constant for the same operational mode.

The computation of the Daily Noise Dose (d_i) follows directly from the fractional noise dose equations by using the relationship:

$$d_i = \frac{C_{i1}}{T_{i1}} + \frac{C_{i2}}{T_{i2}} + \cdot\cdot\cdot + \frac{C_{im}}{T_{im}} = \sum_{j=1}^{m} f_{ij} \qquad (4)$$

This calculation results in a single number descriptor which can be compared to the limit statement in the standard to ascertain exceedance or non-exceedance of allowable limits.

The major results that can be drawn from the computation of the daily noise dose are:

(1) <u>Identification of the number of engineering space personnel exposed to excessive noise levels</u>: This is done on a space by space basis. For example, if we assume that there are eight operators assigned to the engine room, the results will show that for the cruising mode, between 10 and 20 knots, six of these individuals will have exposures in excess of the present OSHA noise regulation and two are in compliance with the standard.

(2) <u>Definition of the magnitude of exceedance and the ability to rank order personnel by noise exposure</u>: An example of this is the same six individuals found over exposed above but now the noise exposure levels for each individual can be rank ordered according to magnitude.

(3) <u>Ability to evaluate, on a comparative basis, the effect of two or more noise standards</u>: An example of this is comparing the BUMED regulation versus the new DOD noise regulation. In this case, using the example of the engine room we might find that according to the BUMED standard only six individuals have excessive noise exposures and in the case of the new DOD standard, all eight individuals have a problem.

(4) <u>Ability to evaluate the noise problem on an operational mode by mode basis</u>: For example, when in port, under auxiliary steaming, only three individuals may have exposures in excess of the Navy standard. On the other hand, when underway, at 25 knots, seven out of the eight individuals may have an excessive noise exposure. This information, together with the knowledge of percent of time that the ship class spends in each operational mode, may be used to judge the importance of each mode on the overall noise exposure problem of the class.

In summary, the procedure suggested in Figure A.1 allows for not only the computation of the daily noise exposure for a given operating mode but also for the assessment of the differences in noise exposure among various standards and operational modes.

A.2 A Model for Noise Reduction Evaluation

This section describes the analysis necessary to define the overall noise reduction requirements in each engineering space based on the personnel noise expsosure results. Furthermore, it describes the sequential steps and data base necessary to establish the contribution of individual noise sources (equipment) to the overall noise at a given location and the definition of individual source noise reduction requirements.

The analysis of the noise exposure problem is done through the use of fractional noise dose data developed as a result of the relationship between duty and noise discussed in the previous section. The objective of this procedure is to identify the minimum noise reduction requirements (ΔL_j) at each location as a function of the total noise exposure problem (not simply noise levels) in an optimum manner. The sequential analysis is shown in Figure A.2. The analysis is limited to individuals who have been identified as having an excessive daily noise exposure dose, d_k. This operation is defined by the first entry in Figure A.2 where the individuals with excessive noise exposures are classified as follows:

$$I_k = I_k(d_k > 1.0) \tag{5}$$

where k is a sub-set of i from 1 to ℓ.

First of all, the fractional noise doses, (f_k) are organized in array form together with the daily noise dose (d_k) as follows:

k \ j	Locations 1	2	3	. . .	m	d_k
1	f_{11}	f_{12}	f_{13}	. . .	f_{1m}	d_1
2	f_{21}	f_{22}	f_{23}	. . .	f_{2m}	d_2
⋮	⋮	⋮	⋮	. . .	⋮	⋮
ℓ	$f_{\ell 1}$	$f_{\ell 2}$	$f_{\ell 3}$	. . .	$f_{\ell m}$	d_ℓ

This presentation summarizes all of the daily noise dose information and shows the contribution of each location to the daily noise dose. It is desirable to classify these locations according to their contribution to the noise exposure problem. This is accomplished through the calculation of the Priority Index (PI) as shown in Figure A.2. First of all, we define the Partial Priority (PP) as:

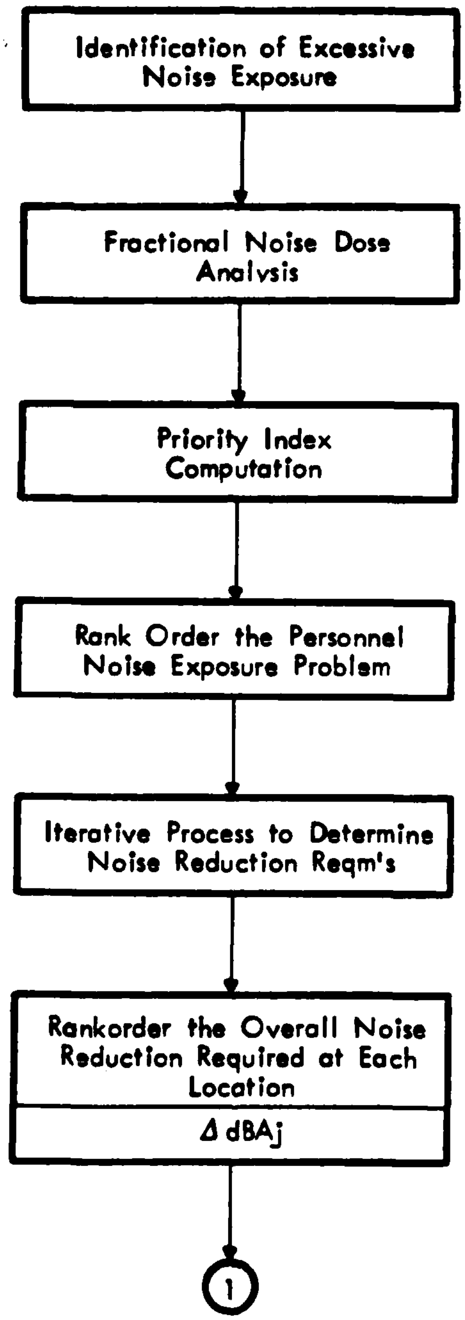


FIGURE A.2 ANALYSIS OF NOISE EXPOSURE

$$(PP)_{kj} \begin{cases} = \dfrac{f_{kj}}{(d_k - 1)} & \text{when} \quad f_{kj} - (d_k - 1) \\ = 1 & \text{when} \quad f_{kj} \quad (d_k - 1) \end{cases} \tag{6}$$

As described by the equation, the Partial Priority is the ratio of the fractional noise dose to the excess daily noise dose. The ratio indicates the <u>fraction of overexposure</u> that would be eliminated from the individual's daily noise dose if the noise level at location j was reduced to the threshold level for the exposure time.

Using Equation (6) the fractional noise dose array may be converted into a Partial Priority array as shown below:

man k \ j	Locations					d_k
	1	2	3	. . .	m	
1	PP_{11}	PP_{12}	PP_{13}	. . .	PP_{1m}	d_1
2	PP_{21}	PP_{22}	PP_{23}	. . .	PP_{2m}	d_2
:	:	:	:		:	:
ℓ	PP_{ℓ_1}	PP_{ℓ_2}	PP_{ℓ_3}	. . .	$PP_{\ell m}$	d_ℓ
$\sum_{k=1}^{\ell} (PP)_{kj}$	PI_1	PI_2	PI_3	. . .	PI_m	

The sum of all individual partial priorities at a given location is defined as the Priority Index (PI) as follows:

$$(PI)_j = \sum_{k=1}^{\ell} (PP)_{kj} \tag{7}$$

The $(PI)_j$ indicator provides a ranking of each area according to where the most reduction in <u>excess noise exposure</u> (not simply noise exposure) could be achieved for the <u>most people</u>. The distribution of $(PI)_j$ also provides a quick assessment of the

relative importance of one location versus another and in that sense serves as a gauge in identifying the "hot spots" which contribute most to overexposure.

Two factors of note about the $(PI)_j$ indicator. Firstly, the maximum value of $(PI)_j$ is one times the number of overexposed individuals considered ($1 x \ell$). For example, if 5 individuals are considered, the maximum value of PI = 5. The significance of obtaining the maximum rating at a given location is that by reducing the noise level at that location to the standard, all individuals considered would be in compliance. In other words, the reduction of the noise level from the measured to the standard (90 dBA for OSHA) at that location will bring the exposure of <u>all individuals</u> to the maximum permissible or below without any controls at other locations regardless of level. Secondly, if more than one individual is considered in each category k (the individual was defined previously as one person or a group of people performing the same work routine), the (PI) indicator may be very simply modified to include a weighting factor that will reflect this case. The required modification includes the addition of a factor N to Equation (6) as follows:

$$(PP)_{kj} \begin{cases} = N_k \cdot \dfrac{f_{kj}}{(d_k - 1)} & \text{when} \quad f_{kj} \leq (d_k - 1) \\ = N_k & \text{when} \quad f_{kj} > (d_k - 1) \end{cases} \qquad (8)$$

where N_k is the number of individuals in category k. This change will also modify the maximum value of $(PI)_j$ from ($1 x \ell$) to:

$$\text{Maximum (PI)} = \sum_{k=1}^{\ell} N_k \qquad (9)$$

In practical cases, the PI indicator is seldom equal to the maximum. In this case, the distribution of PI values allows to rank order the problem areas by location as was pointed out previously. However, the final objective is to evaluate the magnitude of noise reduction that is required at each location to meet a standard. The optimum method to compute the magnitude of noise reduction required is by an iterative process using the PI ranking indicator.

The method calls for reducing the noise level of the highest PI indicator in 1 dB steps until the PI indicator is reduced in magnitude to below the second highest. The operation is repeated until no daily noise dose(s) in excess of the standard are left (i.e., $d_k \leq 1.0$). Each iteration involves the following steps:

(1) Reduce the noise level, (L) by 1 dB at the location with the highest PI_{max}.

(2) Compute the new allowable exposure time, (C) for the new level (L - 1) dBA.

(3) Compute the new fractional noise dose (f) for all individuals affected by this location.

(4) Compute the reduced daily noise dose, (d) for all individuals affected by this location.

(5) Re-compute the PI for all locations. Note that by changing the magnitude of d_k, the values of all $(PP)_{kj}$ are modified. The resulting effect is the reduction of the PI indicator at the location with (L - 1) dBA and the increase of the PI indicator at all other locations.

(6) Repeat the operation until all d_k values are equal to or less than 1. Note as <u>individual</u> values of d_k become unity or less, the corresponding values of f_k in the array become zero and are excluded from further computation.

The result of this operation will provide the <u>minimum amount of noise reduction</u> required at each location that will result in compliance with a standard. This method also optimizes the procedure of assigning noise reduction requirements at each location from the individual's <u>excess noise exposure</u> point of view. The magnitude of noise reduction at each location (expressed in dBA) may now be rank ordered as shown in Figure A.2.

The analysis of the noise exposure problem resulted in the development of noise reduction requirements, ΔdB_j, for each area or location without specifying which <u>sources</u> of noise would require noise reduction. The sequential procedure designed to evaluate the individual equipment noise reduction is shown in Figure A.3.*

Before we enter into the discussion of equipment noise reduction requirements it must be noted that no simplistic procedure for this step is possible since, for the case where two or more sources contribute excessively to the noise level at a location, an infinite number of source noise reduction combinations is possible. Furthermore, the assignment of noise reduction to a specific equipment item generally must be weighted with some engineering judgement as to the feasibility and practicality of

* Note that in addition to the magnitude, the noise reduction requirement retains the statistics associated with the original noise level. For example, a reduction requirement of 10 dB is computed for a location whose mean noise level was described as 95.0 dBA with a standard deviation ( ) of 2.0 dB. Therefore, a noise reduction requirement of 14.0 dB (10 + 2) would assure that 95% of the ships within the class would meet the standard at that location.

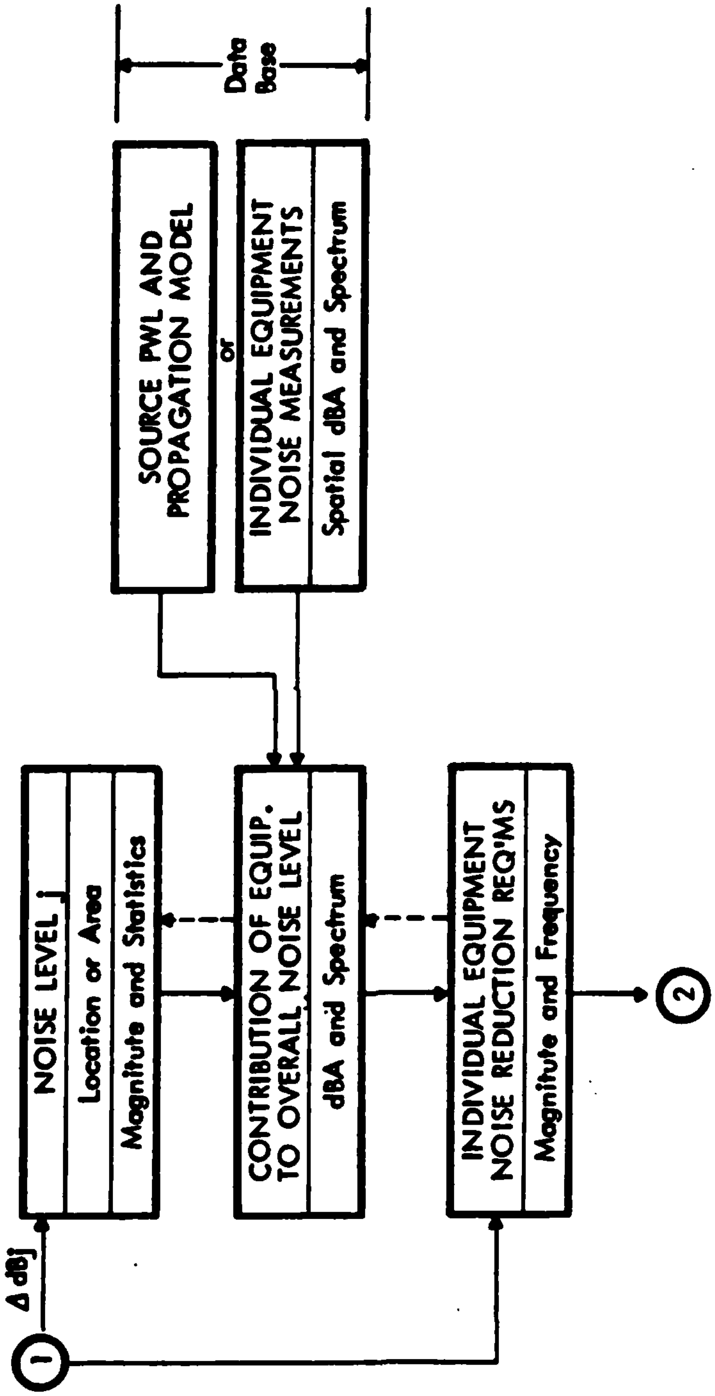


FIGURE A.3 ANALYSIS OF NOISE PROBLEM

achieving the desired reduction. Finally, we must recognize the economic trade-off value by weighting the reduction of one machine versus another. For example, often it is more expedient and cost-effective to require a substantially higher reduction of one item over another although the noise level contribution of both may be the same. With these facts in mind, the following procedure is presented as a guide rather than a strict methodology.

First of all, it is necessary to know which equipment items or equipment components contribute to the noise level at the location of interest. In other words, what is the noise level, in terms of magnitude and frequency, that may be associated with each equipment item. This requirement defines the need for a second type of acoustic data base. The objectives for developing the data base are to describe the noise environment in terms of the individual components and their paths of propagation.

The analysis of the noise environment is very often a complicated problem, especially in a shipboard situation due to the number of sources that must be considered and the complexity of the space within which the noise is propagated. Two approaches are possible:

(1) Diagnostic Noise Data: This method relies on a systematic data base accumulation in which individual pieces of equipment are operated, one by one, and their contribution at different locations within the engineering space is measured simultaneously. The procedure requires not only sophisticated measurement techniques, but many repetitive measurements before confidence limits to different locations across the class can be established. Information typically is presented in dBA and in octave bands or third octave bands of frequency. Narrow band data and equipment noise radiation characteristics are

sometimes also available. In addition to the acoustic data the operational characteristics of the ship and machinery under which the test was performed must also be well documented.

(2) Analytic Approach: This approach relies on a measurement or estimation of Sound Power Level (PWL) for each source and a propagation model that will allow the prediction of the sound pressure level (SPL) of the source as a function of frequency at any specific location in the compartment. Due to the very complex reflection and the diffraction environment common to machinery dense engineering spaces, this methodology may only have a limited application to the Navy noise problem under the present state-of-the-art.

Using the diagnostic noise data, the noise levels at location j are reconstructed in terms of the individual contributors as shown in Figure A.3. Based on the overall noise reduction requirements, the individual equipment noise reductions are computed in terms of magnitude and frequency.

Note that the knowledge of the contribution of individual equipment items to the overall noise environment at a location may be used to compute the effect of an individual control on the personnel noise exposure problem. That is, if we assume that a 15 dBA control is available for the gear train, then this information may be used to recompute the noise levels at all locations affected by this item. Then the procedure indicated in Figure A.1 is repeated. This action allows for a quick "cause - effect" assessment of controlling this equipment item on all personnel affected and provides a tool for individual equipment noise control trade-off analysis.

2.4 A Model for Cost Estimation of Noise Control

In the previous sections the assessment of personnel noise exposure and individual noise reduction requirements for equipment responsible for excessive noise levels was discussed. This section will dwell on the aspect of noise control alternatives that can be introduced to mitigate the noise problem and with the evaluation of noise control costs. Figure A.4 shows the sequential steps suggested to arrive at the estimate of noise control costs.

First of all, the figure shows the individual source noise reduction requirements that were developed in the previous analysis. These requirements are given for each piece of equipment in terms of magnitude and frequency.

The noise reduction requirements can now be addressed in terms of noise control technology which can be applied to the Navy environment. The noise control technology represents the third type of data base required in the model.

The purpose of the noise control data base is to identify the type and quantify the performance of noise reduction systems that may be applied to existing sources of excessive noise. This includes a description of the physical characteristics of the control measure, its mode of application and installation, and the expected or measured noise reduction performance. The noise control techniques fall naturally into two groups:

(1) Proven Noise Controls: This group includes successful noise control treatments that are documented by their performance history from Navy applications. The objective here is to list all of the noise control measures that have been successfully developed and implemented in shipboard environments. Data such as the type of

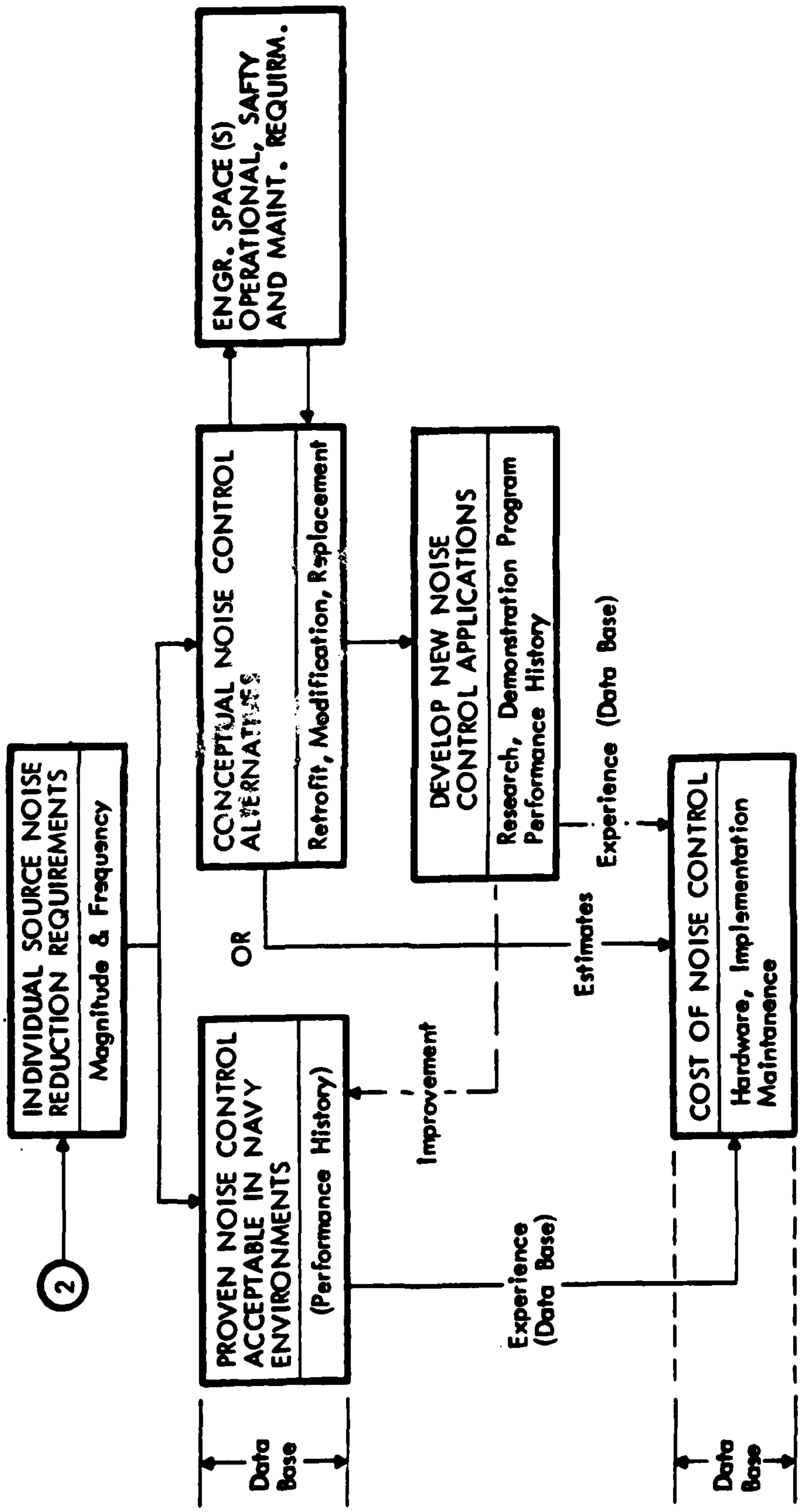


FIGURE A.4 NOISE CONTROL ALTERNATIVES AND COSTS

treatment, configuration, description of its application, and the amount of the noise reduction achieved through the application are required in this portion of the data base.

(2) Conceptual Noise Controls: This group includes noise control treatments used in other than Navy applications or noise control concepts which have not yet been proven successful in shipboard environments. These measures may take the form of:

a) Retrofit Controls: This generally refers to systems that contain the noise near the source, i.e. enclosures, partial barriers, damping, etc.

b) Modifications: This generally refers to replacement of machine parts with quieter ones or the addition of noise control components.

c) Replacement of Sources: This generally means replacing noisy equipment units with quieter versions.

d) Space Treatment: This generally means acoustic absorbtive treatment of the space boundaries with the objective to reduce the reverberant noise level contribution.

The assessment of these conceptual noise control alternatives must be made in line with the operational, safety and maintenance requirements of the engineering spaces in which the installation must be made. In that sense, some of the shipboard operational constraints are taken into account at this stage, even though no performance history is available for the controls.

The final design of the conceptual noise control alternatives into proven noise controls acceptable in shipboard environments must, in many cases, go through a developmental phase which may be construed as new noise control applications. The new noise control applications may take the form of a demonstration program where potential noise controls are implemented on a vessel and the performance history of the design is monitored.

Both proven noise controls and conceptual noise control alternatives are now the subject of cost estimates. The cost of noise control represents the fourth and last type of data base required in the model. The purpose of the cost data base is to identify the cost of hardware, implementation and maintenance of each noise control measure.

The cost data base for the proven noise control techniques are acquired from the experience gained in the installations. Here variability due to the method of installation (using Navy personnel, civilian Navy shipyard personnel or outside contractors) may be evaluated and be the subject of statistical treatment if appropriate. No such experience exists for the conceptual noise controls since these have not been implemented on Navy vessels and the cost of hardware, implementation and maintenance must necessarily be only a first order estimate. It is recommended that shipyard estimators be used for that purpose and an average value from three or more sources used.

The cost of noise control data base may now be used to arrive at the total cost of noise control for each vessel and the class based on the noise reduction requirements of a specific standard. The procedure allows for the development of a number of cost trade-off analyses; the two most prominent being:

(1) The determination of the absolute and relative costs of compliance between two or more noise standards. For

example, the cost of compliance with present DOD standard.

(2) The cost-benefit analysis of individual noise controls where the number of individuals in compliance as a result of the implementation of a control may be assessed on its own merits or versus another control.

The above analysis may be used to develop budgetary estimates for appropriation requests and to assist in defining those noise sources which are most critical from the standpoint of potential hearing damage.

APPENDIX B

Sound Survey Form

SOUND SURVEY FORM

CODE	GENERAL INFORMATION		CODE	OPERATING CONDITIONS	
	Ship's Class	FF1052 KNOX		Readiness ①	Cond. I ☐ Cond. III ☐
	Space Surveyed	Engine Rm. Lower Level			Cond. IV ☐ Cond. V ☐
	Ship's Name			Operating Mode	
	Survey Date	/ /		(a) In-Port	Cold Iron ☐
	Time of Day				Aux. Steaming ☐
	Inspected by			(b) Underway	Speed ______kts
	Meter Type				Shaft ______rpm
	Serial Number				

SOUND LEVEL DATA

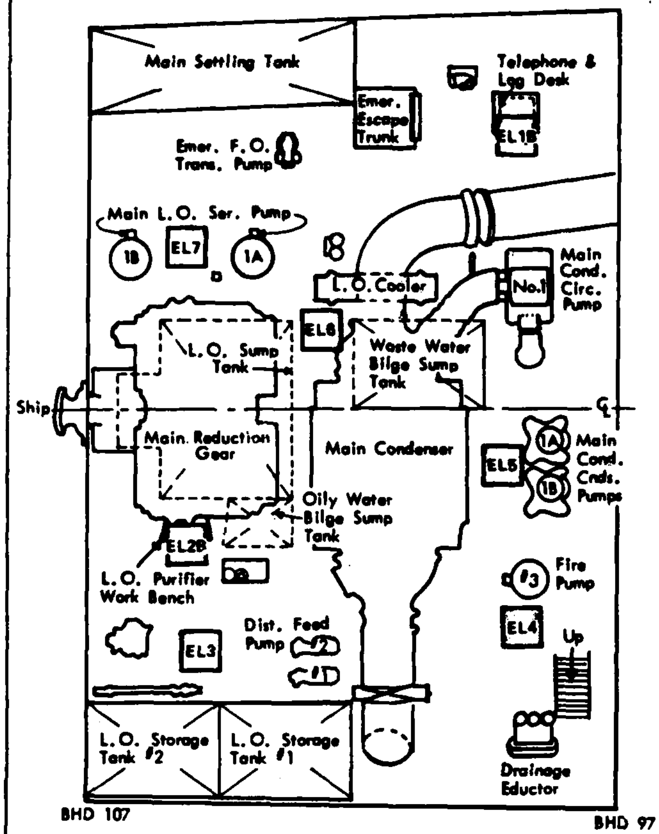
LOC. CODE	MEAS. LOC.	dBA	INTER ② ?	COMMENTS ③	LOC. CODE	MEAS. LOC.	dBA	INTER. ?	COMMENTS
	EL1B					EL6			
	EL2B					EL7			
	EL3								
	EL4								
	EL5								

PERSONNEL ASSIGNMENT DATA

LOC. CODE	MEAS. ④ LOC.	BILLET TITLE	RATE ⑤	WEAR ⑥ PROT. ?	WATCH ⑦ STAND ?	HRS./DAY AT LOC. ⑧		COMMENTS ⑨
						WORK	WATCH	

FF1052 Class

SPACE: Engine Rm. Lower Level



MACHINERY LINE-UP (OPTIONAL)

CODE	DESCRIPTION	ON(√)
	Main Reduction Gear	
	Main Condensate Pump 1A	
	Main Condensate Pump 1B	
	Fire Pump No. 3	
	Main Condensate Circulation Pump No. 1	
	Main L.O. Service Pump 1A	
	Main L.O. Service Pump 1B	
	L.O. Purifier No. 1	
	Distillate Feed Pump No. 1	
	Distillate Feed Pump No. 2	
	Drainage Eductor	
	Emergency F.O. Transfer Pump	

DEFINITION OF PERSONNEL RATES

RATE	RATE DESCRIPTION	DIVISION
MMC	Machinist Mate - Chief	A
MM1	Machinist Mate - 1st Class	A
MM2	Machinist Mate - 2nd Class	A
MM3	Machinist Mate - 3rd Class	A
MMFN	Machinist Mate - Fireman	A
FN	Fireman	A
BTCM	Boiler Tender - Master Chief	B
BT1	Boiler Tender - 1st Class	B
BT2	Boiler Tender - 2nd Class	B
BT3	Boiler Tender - 3rd Class	B
BTFN	Boiler Tender - Fireman	B
EMC	Electrician Mate - Chief	E
EM1	Electrician Mate - 1st Class	E
EM2	Electrician Mate - 2nd Class	E
EM3	Electrician Mate - 3rd Class	E
EMFN	Electrician Mate - Fireman	E
MMCS	Machinist Mate - Senior Chief	M
MM1	Machinist Mate - 1st Class	M
MM2	Machinist Mate - 2nd Class	M
MM3	Machinist Mate - 3rd Class	M
MMFN	Machinist Mate - Fireman	M
FN	Fireman	M

DEFINITIONS & AMPLIFICATIONS

1 **Readiness**	Cond. I - General Quarters Cond. III - Wartime Steaming Cond. IV - Peacetime Steaming Cond. V - In-Port
2 **Inter. ?**	Stands for "Is the noise level intermittent?" The question mark (?) requires a "yes" or "no" answer. Intermittent noise is defined as the sound generated by machinery which is cycled on and off and results in large fluctuations in noise levels (more than 5 dBA).
3 **Comments**	Should be used to note faulty machinery or any other factor that, by inspection, may be responsible for an unusual noise environment at the measurement location.
4 **Meas. Loc.**	Enter the sound level measurement symbol which is located closest to the individual's position (see Figure).
5 **Rate**	Enter individual's rate abbreviation as shown on the personnel rate table; i.e. Boiler Tender, First Class-BT1.
6 **Wear Prot. ?**	Stands for "Is the individual wearing personal hearing protection?" such as earplugs or earmuffs. The question mark (?) requires an "yes" or "no" answer.
7 **Watch Stand ?**	Stands for "Is the individual a watch stander or a watch stander trainee?". The question mark (?) requires a "yes" or "no" answer.
8 **Hrs/Day at Loc.**	Enter the number of hours (to closest ¼ hour) that the individual works at location. If answer is "yes" to 7 enter number of hours spent as a watch stander at location.
9 **Comments**	Should be used to describe work task when appropriate.

SOUND SURVEY FORM

CODE	GENERAL INFORMATION		CODE	OPERATING CONDITIONS	
	Ship's Class	FF1052 KNOX		Readiness ①	Cond. I☐ Cond. III☐
	Space Surveyed	Engine Rm., Upper Level			Cond. IV☐ Cond. V☐
	Ship's Name	________		Operating Mode	
	Survey Date	___/___/___		(a) In-Port	Cold Iron ☐
	Time of Day	________			Aux. Steaming ☐
	Inspected by	________		(b) Underway	Speed ______kts
	Meter Type	________			Shaft ______rpm
	Serial Number	________			

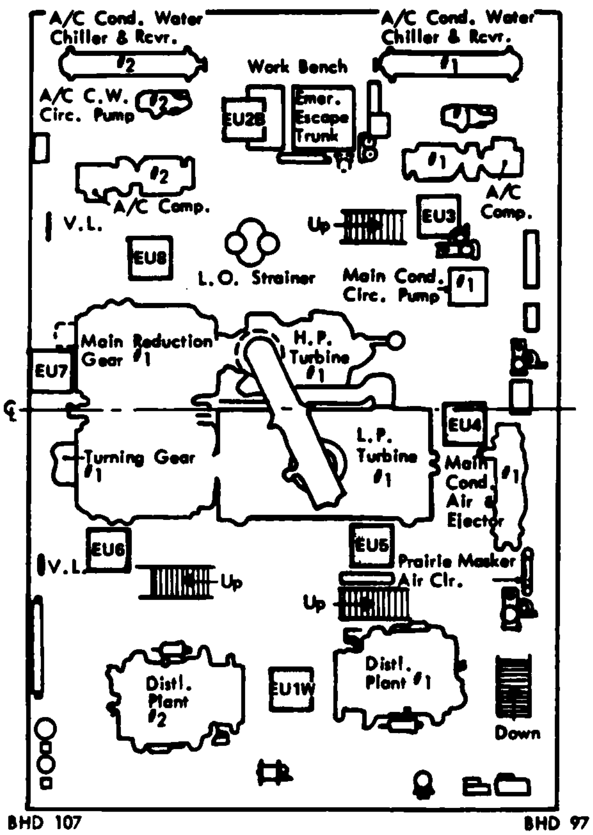
SOUND LEVEL DATA

LOC. CODE	MEAS. LOC.	dBA	INTER ② ?	COMMENTS ③	LOC. CODE	MEAS. LOC.	dBA	INTER. ?	COMMENTS
	EU1W					EU6			
	EU2B					EU7			
	EU3					EU8			
	EU4								
	EU5								

PERSONNEL ASSIGNMENT DATA

LOC. CODE	MEAS. ④ LOC.	BILLET TITLE	RATE ⑤	WEAR ⑥ PROT. ?	WATCH ⑦ STAND ?	HRS./DAY AT LOC. ⑧ WORK	WATCH	COMMENTS ⑨

SPACE: Engine Room – Upper Level



MACHINERY LINE-UP (OPTIONAL)		
CODE	DESCRIPTION	ON(✓)
	Main Reduction Gear/H.P. Turbine/L.P. Turbine	
	Distilling Plant No. 1	
	Distilling Plant No. 2	
	L.O. Strainer	
	Main Condensate Circulation Pump	
	Main Condensate Air Ejector	
	Air Conditioning Compressor No. 1	
	Air Conditioning Compressor No. 2	
	A/C Chilled Water Circulation Pump No. 1	
	A/C Chilled Water Circulation Pump No. 2	

DEFINITION OF PERSONNEL RATES

RATE	RATE DESCRIPTION	DIVISION
MMC	Machinist Mate - Chief	A
MM1	Machinist Mate - 1st Class	A
MM2	Machinist Mate - 2nd Class	A
MM3	Machinist Mate - 3rd Class	A
MMFN	Machinist Mate - Fireman	A
FN	Fireman	A
BTCM	Boiler Tender - Master Chief	B
BT1	Boiler Tender - 1st Class	B
BT2	Boiler Tender - 2nd Class	B
BT3	Boiler Tender - 3rd Class	B
BTFN	Boiler Tender - Fireman	B
EMC	Electrician Mate - Chief	E
EM1	Electrician Mate - 1st Class	E
EM2	Electrician Mate - 2nd Class	E
EM3	Electrician Mate - 3rd Class	E
EMFN	Electrician Mate - Fireman	E
MMCS	Machinist Mate - Senior Chief	M
MM1	Machinist Mate - 1st Class	M
MM2	Machinist Mate - 2nd Class	M
MM3	Machinist Mate - 3rd Class	M
MMFN	Machinist Mate - Fireman	M
FN	Fireman	M

DEFINITIONS & AMPLIFICATIONS

① Readiness	Cond. I - General Quarters Cond. III - Wartime Steaming Cond. IV - Peacetime Steaming Cond. V - In-Port
② Inter. ?	Stands for "is the noise level intermittent?" The question mark (?) requires a "yes" or "no" answer. Intermittent noise is defined as the sound generated by machinery which is cycled on and off and results in large fluctuations in noise levels (more than 5 dBA).
③ Comments	Should be used to note faulty machinery or any other factor that, by inspection, may be responsible for an unusual noise environment at the measurement location.
④ Meas. Loc.	Enter the sound level measurement symbol which is located closest to the individual's position (see Figure).
⑤ Rate	Enter individual's rate abbreviation as shown on the personnel rate table; i.e. Boiler Tender, First Class-BT1.
⑥ Wear Prot. ?	Stands for "is the individual wearing personal hearing protection?" such as earplugs or earmuffs. The question mark (?) requires an "yes" or "no" answer.
⑦ Watch Stand ?	Stands for "is the individual a watch stander or a watch stander trainee?". The question mark (?) requires a "yes" or "no" answer.
⑧ Hrs/Day at Loc.	Enter the number of hours (to closest ¼ hour) that the individual works at location. If answer is "yes" to ⑦ enter number of hours spent as a watch stander at location.
⑨ Comments	Should be used to describe work task when appropriate.

SOUND SURVEY FORM

CODE	GENERAL INFORMATION		CODE	OPERATING CONDITIONS	
	Ship's Class	FF1052 KNOX		Readiness ①	Cond. I☐ Cond. III☐
	Space Surveyed	Engine Rm. – 2nd Deck			Cond. IV☐ Cond. V☐
	Ship's Name			Operating Mode	
	Survey Date	/ /		(a) In-Port	Cold Iron ☐
	Time of Day				Aux. Steaming ☐
	Inspected by			(b) Underway	Speed ______kts
	Meter Type				Shaft ______rpm
	Serial Number				

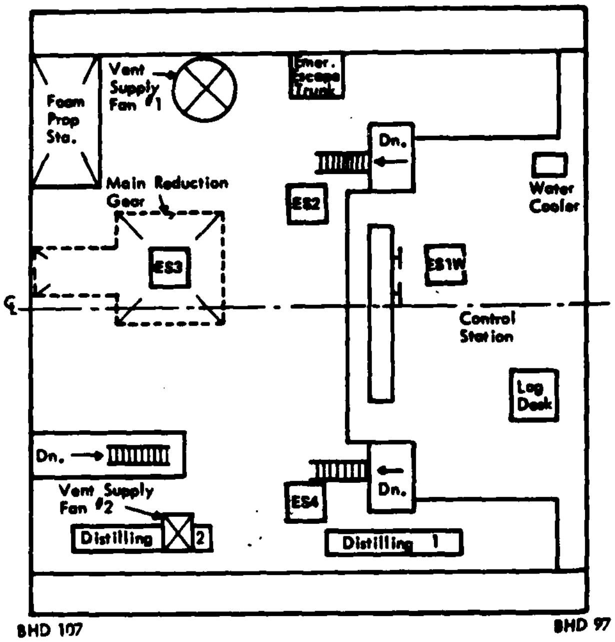
SOUND LEVEL DATA

LOC. CODE	MEAS. LOC.	dBA	INTER ② ?	COMMENTS ③	LOC. CODE	MEAS. LOC.	dBA	INTER. ?	COMMENTS
	ES1W								
	ES 2								
	ES 3								
	ES 4								

PERSONNEL ASSIGNMENT DATA

LOC. CODE	MEAS. ④ LOC.	BILLET TITLE	RATE ⑤	WEAR ⑥ PROT. ?	WATCH ⑦ STAND ?	HRS./DAY AT LOC. ⑧		COMMENTS ⑨
						WORK	WATCH	

SPACE: Engine Rm. – 2nd Deck



MACHINERY LINE-UP (OPTIONAL)

CODE	DESCRIPTION	ON(√)
	Vent Supply Fan No. 1	
	Vent Supply Fan No. 2	

DEFINITION OF PERSONNEL RATES

RATE	RATE DESCRIPTION	DIVISION
MMC	Machinist Mate - Chief	A
MM1	Machinist Mate - 1st Class	A
MM2	Machinist Mate - 2nd Class	A
MM3	Machinist Mate - 3rd Class	A
MMFN	Machinist Mate - Fireman	A
FN	Fireman	A
BTCM	Boiler Tender - Master Chief	B
BT1	Boiler Tender - 1st Class	B
BT2	Boiler Tender - 2nd Class	B
BT3	Boiler Tender - 3rd Class	B
BTFN	Boiler Tender - Fireman	B
EMC	Electrician Mate - Chief	E
EM1	Electrician Mate - 1st Class	E
EM2	Electrician Mate - 2nd Class	E
EM3	Electrician Mate - 3rd Class	E
EMFN	Electrician Mate - Fireman	E
MMCS	Machinist Mate - Senior Chief	M
MM1	Machinist Mate - 1st Class	M
MM2	Machinist Mate - 2nd Class	M
MM3	Machinist Mate - 3rd Class	M
MMFN	Machinist Mate - Fireman	M
FN	Fireman	M

DEFINITIONS & AMPLIFICATIONS

① **Readiness**	Cond. I - General Quarters Cond. III - Wartime Steaming Cond. IV - Peacetime Steaming Cond. V - In-Port
② **Inter. ?**	Stands for "is the noise level intermittent?" The question mark (?) requires a "yes" or "no" answer. Intermittent noise is defined as the sound generated by machinery which is cycled on and off and results in large fluctuations in noise levels (more than 5 dBA).
③ **Comments**	Should be used to note faulty machinery or any other factor that, by inspection, may be responsible for an unusual noise environment at the measurement location.
④ **Meas. Loc.**	Enter the sound level measurement symbol which is located closest to the individual's position (see Figure).
⑤ **Rate**	Enter individual's rate abbreviation as shown on the personnel rate table; i.e. Boiler Tender, First Class-BT1.
⑥ **Wear Prot. ?**	Stands for "is the individual wearing personal hearing protection?" such as earplugs or earmuffs. The question mark (?) requires an "yes" or "no" answer.
⑦ **Watch Stand ?**	Stands for "is the individual a watch stander or a watch stander trainee?". The question mark (?) requires a "yes" or "no" answer.
⑧ **Hrs/Day at Loc.**	Enter the number of hours (to closest ¼ hour) that the individual works at location. If answer is "yes" to ⑦ enter number of hours spent as a watch stander at location.
⑨ **Comments**	Should be used to describe work task when appropriate.

FF1052 Class

SOUND SURVEY FORM

CODE	GENERAL INFORMATION		CODE	OPERATING CONDITIONS	
	Ship's Class	FF1052 KNOX		Readiness ①	Cond. I ☐ Cond. III ☐
	Space Surveyed	Fire Rm. – Lower Level			Cond. IV ☐ Cond. V ☐
	Ship's Name			Operating Mode	
	Survey Date	/ /		(a) In-Port	Cold Iron ☐
	Time of Day				Aux. Steaming ☐
	Inspected by			(b) Underway	Speed ____ kts
	Meter Type				Shaft ____ rpm
	Serial Number			Prairie Masker	On ☐ Off ☐

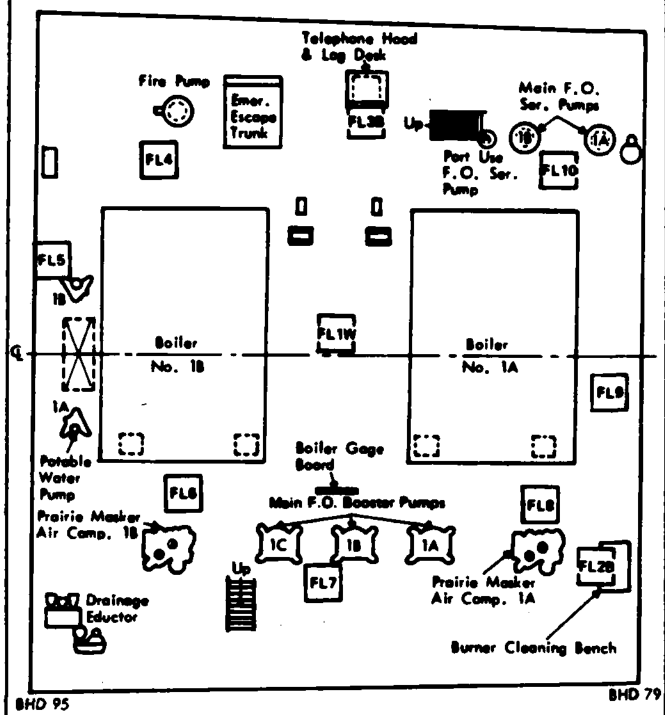
SOUND LEVEL DATA

LOC. CODE	MEAS. LOC.	dBA	INTER ② ?	COMMENTS ③	LOC. CODE	MEAS. LOC.	dBA	INTER. ?	COMMENTS
	FL1W					FL6			
	FL2B					FL7			
	FL3B					FL8			
	FL4					FL9			
	FL5					FL10			

PERSONNEL ASSIGNMENT DATA

LOC. CODE	MEAS. ④ LOC.	BILLET TITLE	RATE ⑤	WEAR ⑥ PROT. ?	WATCH ⑦ STAND ?	HRS./DAY AT LOC. ⑧		COMMENTS ⑨
						WORK	WATCH	

SPACE: Fire Rm. — Lower Level



MACHINERY LINE-UP (OPTIONAL)

CODE	DESCRIPTION	ON(✓)
	Boiler No. 1A	
	Boiler No. 1B	
	Main Fuel Oil Service Pump 1A ✓	
	Main Fuel Oil Service Pump 1B	
	Main Feed Booster Pump 1A	
	Main Feed Booster Pump 1B ✓	
	Main Feed Booster Pump 1C	
	Fire Pump No. 2	
	Prairie Masker Air Compressor No. 1A	
	Prairie Masker Air Compressor No. 1B	
	Port Use Fuel Oil Service Pump	
	Potable Water Pump 1A	
	Potable Water Pump 1B	
	Drainage Eductor	

DEFINITION OF PERSONNEL RATES

RATE	RATE DESCRIPTION	DIVISION
MMC	Machinist Mate - Chief	A
MM1	Machinist Mate - 1st Class	A
MM2	Machinist Mate - 2nd Class	A
MM3	Machinist Mate - 3rd Class	A
MMFN	Machinist Mate - Fireman	A
FN	Fireman	A
BTCS BTC BTCM	Boiler Tender - Master Chief	B
BT1	Boiler Tender - 1st Class	B
BT2	Boiler Tender - 2nd Class	B
BT3	Boiler Tender - 3rd Class	B
BTFN FA FR	Boiler Tender - Fireman	B
EMC	Electrician Mate - Chief	E
EM1	Electrician Mate - 1st Class	E
EM2	Electrician Mate - 2nd Class	E
EM3	Electrician Mate - 3rd Class	E
EMFN	Electrician Mate - Fireman	E
MMCS	Machinist Mate - Senior Chief	M
MM1	Machinist Mate - 1st Class	M
MM2	Machinist Mate - 2nd Class	M
MM3	Machinist Mate - 3rd Class	M
MMFN	Machinist Mate - Fireman	M
FN	Fireman	M

DEFINITIONS & AMPLIFICATIONS

① **Readiness**	Cond. I - General Quarters Cond. III - Wartime Steaming Cond. IV - Peacetime Steaming Cond. V - In-Port
② **Inter. ?**	Stands for "Is the noise level intermittent?" The question mark (?) requires a "yes" or "no" answer. Intermittent noise is defined as the sound generated by machinery which is cycled on and off and results in large fluctuations in noise levels (more than 5 dBA).
③ **Comments**	Should be used to note faulty machinery or any other factor that, by inspection, may be responsible for an unusual noise environment at the measurement location.
④ **Meas. Loc.**	Enter the sound level measurement symbol which is located closest to the individual's position (see Figure).
⑤ **Rate**	Enter individual's rate abbreviation as shown on the personnel rate table; i.e. Boiler Tender, First Class-BT1.
⑥ **Wear Prot. ?**	Stands for "Is the individual wearing personal hearing protection?" such as earplugs or earmuffs. The question mark (?) requires an "yes" or "no" answer.
⑦ **Watch Stand ?**	Stands for "Is the individual a watch stander or a watch stander trainee?". The question mark (?) requires a "yes" or "no" answer.
⑧ **Hrs/Day at Loc.**	Enter the number of hours (to closest ½ hour) that the individual works at location. If answer is "yes" to ⑦ enter number of hours spent as a watch stander at location.
⑨ **Comments**	Should be used to describe work task when appropriate.

SOUND SURVEY FORM

CODE	GENERAL INFORMATION		CODE	OPERATING CONDITIONS	
	Ship's Class	FF1052 KNOX		Readiness ①	Cond. I☐ Cond. III☐
	Space Surveyed	Fire Rm. – Upper Level			Cond. IV☐ Cond. V☐
	Ship's Name	______		Operating Mode	
	Survey Date	__/__/__		(a) In-Port	Cold Iron ☐
	Time of Day	______			Aux. Steaming ☐
	Inspected by	______		(b) Underway	Speed ______kts
	Meter Type	______			Shaft ______rpm
	Serial Number	______		Prairie Masker	On ☐ Off ☐

SOUND LEVEL DATA

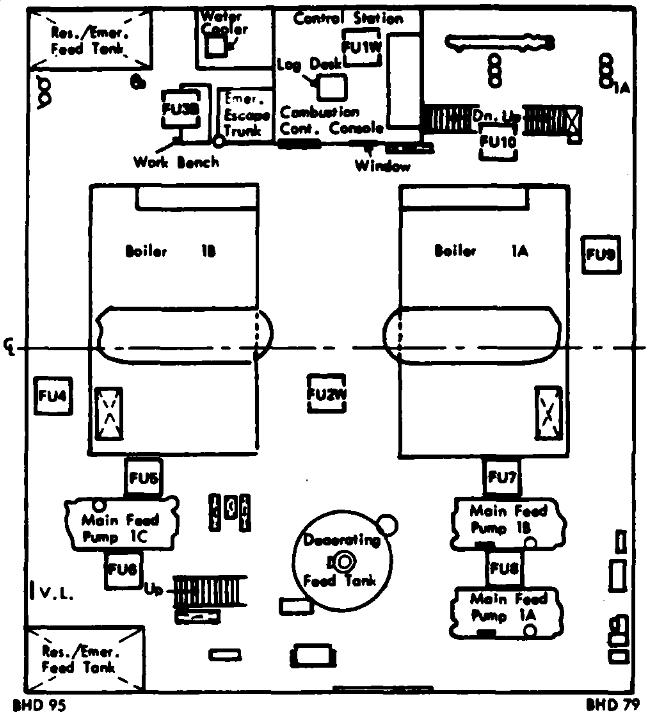
LOC. CODE	MEAS. LOC.	dBA	INTER ② ?	COMMENTS ③	LOC. CODE	MEAS. LOC.	dBA	INTER. ?	COMMENTS
	FU1W					FU 6			
	FU2W					FU 7			
	FU3B					FU 8			
	FU 4					FU 9			
	FU 5					FU10			

PERSONNEL ASSIGNMENT DATA

LOC. CODE	MEAS. ④ LOC.	BILLET TITLE	RATE ⑤	WEAR ⑥ PROT. ?	WATCH ⑦ STAND ?	HRS./DAY AT LOC. ⑧		COMMENTS ⑨
						WORK	WATCH	

FF1052 Class

SPACE: Fire Rm. – Upper Level



MACHINERY LINE-UP (OPTIONAL)		
CODE	DESCRIPTION	ON(✓)
	Boiler 1A	
	Boiler 1B	✓
	Main Feed Pump 1A ✓	✓
	Main Feed Pump 1B	
	Main Feed Pump 1C ✓	✓

DEFINITION OF PERSONNEL RATES

RATE	RATE DESCRIPTION	DIVISION
MMC	Machinist Mate - Chief	A
MM1	Machinist Mate - 1st Class	A
MM2	Machinist Mate - 2nd Class	A
MM3	Machinist Mate - 3rd Class	A
MMFN	Machinist Mate - Fireman	A
FN	Fireman	A
BTCM	Boiler Tender - Master Chief	B
BT1	Boiler Tender - 1st Class	B
BT2	Boiler Tender - 2nd Class	B
BT3	Boiler Tender - 3rd Class	B
BTFN	Boiler Tender - Fireman	B
EMC	Electrician Mate - Chief	E
EM1	Electrician Mate - 1st Class	E
EM2	Electrician Mate - 2nd Class	E
EM3	Electrician Mate - 3rd Class	E
EMFN	Electrician Mate - Fireman	E
MMCS	Machinist Mate - Senior Chief	M
MM1	Machinist Mate - 1st Class	M
MM2	Machinist Mate - 2nd Class	M
MM3	Machinist Mate - 3rd Class	M
MMFN	Machinist Mate - Fireman	M
FN	Fireman	M

DEFINITIONS & AMPLIFICATIONS

① **Readiness**	Cond. I - General Quarters Cond. III - Wartime Steaming Cond. IV - Peacetime Steaming Cond. V - In-Port
② **Inter. ?**	Stands for "is the noise level intermittent?" The question mark (?) requires a "yes" or "no" answer. Intermittent noise is defined as the sound generated by machinery which is cycled on and off and results in large fluctuations in noise levels (more than 5 dBA).
③ **Comments**	Should be used to note faulty machinery or any other factor that, by inspection, may be responsible for an unusual noise environment at the measurement location.
④ **Meas. Loc.**	Enter the sound level measurement symbol which is located closest to the individual's position (see Figure).
⑤ **Rate**	Enter individual's rate abbreviation as shown on the personnel rate table; i.e. Boiler Tender, First Class-BT1.
⑥ **Wear Prot. ?**	Stands for "is the individual wearing personal hearing protection?" such as earplugs or earmuffs. The question mark (?) requires an "yes" or "no" answer.
⑦ **Watch Stand ?**	Stands for "is the individual a watch stander or a watch stander trainee?". The question mark (?) requires a "yes" or "no" answer.
⑧ **Hrs/Day at Loc.**	Enter the number of hours (to closest ¼ hour) that the individual works at location. If answer is "yes" to ⑦ enter number of hours spent as a watch stander at location.
⑨ **Comments**	Should be used to describe work task when appropriate.

SOUND SURVEY FORM

CODE	GENERAL INFORMATION		CODE	OPERATING CONDITIONS	
	Ship's Class	FF1052 KNOX		Readiness ①	Cond. I ☐ Cond. III ☐
	Space Surveyed	Fire Rm. – 2nd Deck			Cond. IV ☐ Cond. V ☐
	Ship's Name			Operating Mode	
	Survey Date	/ /		(a) In-Port	Cold Iron ☐
	Time of Day				Aux. Steaming ☐
	Inspected by			(b) Underway	Speed ____ kts
	Meter Type				Shaft ____ rpm
	Serial Number			Prairie Masker	On ☐ Off ☐

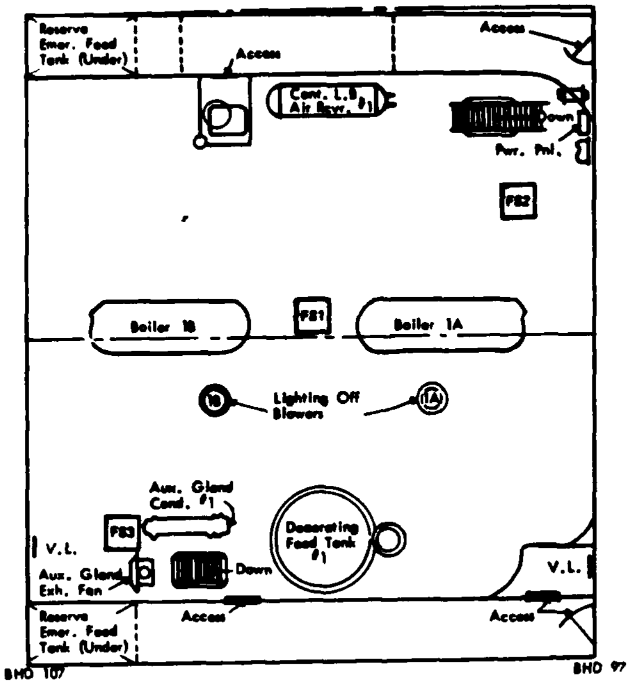
SOUND LEVEL DATA

LOC. CODE	MEAS. LOC.	dBA	INTER ② ?	COMMENTS ③	LOC. CODE	MEAS. LOC.	dBA	INTER. ?	COMMENTS
	FS 1								
	FS 2								
	FS 3								

PERSONNEL ASSIGNMENT DATA

LOC. CODE	MEAS. ④ LOC.	BILLET TITLE	RATE ⑤	WEAR ⑥ PROT. ?	WATCH ⑦ STAND ?	HRS./DAY AT LOC. ⑧ WORK	WATCH	COMMENTS ⑨

SPACE: Fire Rm. – 2nd Deck



MACHINERY LINE-UP (OPTIONAL)

CODE	DESCRIPTION	ON(✓)
	Boiler 1A ✓	
	Boiler 1B	
	Auxiliary Gland Exhaust Fan ✓	

DEFINITION OF PERSONNEL RATES

RATE	RATE DESCRIPTION	DIVISION
MMC	Machinist Mate - Chief	A
MM1	Machinist Mate - 1st Class	A
MM2	Machinist Mate - 2nd Class	A
MM3	Machinist Mate - 3rd Class	A
MMFN	Machinist Mate - Fireman	A
FN	Fireman	A
BTCM	Boiler Tender - Master Chief	B
BT1	Boiler Tender - 1st Class	B
BT2	Boiler Tender - 2nd Class	B
BT3	Boiler Tender - 3rd Class	B
BTFN	Boiler Tender - Fireman	B
EMC	Electrician Mate - Chief	E
EM1	Electrician Mate - 1st Class	E
EM2	Electrician Mate - 2nd Class	E
EM3	Electrician Mate - 3rd Class	E
EMFN	Electrician Mate - Fireman	E
MMCS	Machinist Mate - Senior Chief	M
MM1	Machinist Mate - 1st Class	M
MM2	Machinist Mate - 2nd Class	M
MM3	Machinist Mate - 3rd Class	M
MMFN	Machinist Mate - Fireman	M
FN	Fireman	M

DEFINITIONS & AMPLIFICATIONS

① Readiness	Cond. I - General Quarters Cond. III - Wartime Steaming Cond. IV - Peacetime Steaming Cond. V - In-Port
② Inter. ?	Stands for "is the noise level intermittent?" The question mark (?) requires a "yes" or "no" answer. Intermittent noise is defined as the sound generated by machinery which is cycled on and off and results in large fluctuations in noise levels (more than 5 dBA).
③ Comments	Should be used to note faulty machinery or any other factor that, by inspection, may be responsible for an unusual noise environment at the measurement location.
④ Meas. Loc.	Enter the sound level measurement symbol which is located closest to the individual's position (see Figure).
⑤ Rate	Enter individual's rate abbreviation as shown on the personnel rate table; i.e. Boiler Tender, First Class-BT1.
⑥ Wear Prot. ?	Stands for "is the individual wearing personal hearing protection?" such as earplugs or earmuffs. The question mark (?) requires an "yes" or "no" answer.
⑦ Watch Stand ?	Stands for "is the individual a watch stander or a watch stander trainee?". The question mark (?) requires a "yes" or "no" answer.
⑧ Hrs/Day at Loc.	Enter the number of hours (to closest ¼ hour) that the individual works at location. If answer is "yes" to ⑦ enter number of hours spent as a watch stander at location.
⑨ Comments	Should be used to describe work task when appropriate.

SOUND SURVEY FORM

CODE	GENERAL INFORMATION		CODE	OPERATING CONDITIONS	
	Ship's Class	FF1052 KNOX		Readiness ①	Cond. I ☐ Cond. III ☐
	Space Surveyed	Aux. Rm. #1, Lower Level			Cond. IV ☐ Cond. V ☐
	Ship's Name			Operating Mode	
	Survey Date	/ /		(a) In-Port	Cold Iron ☐
	Time of Day				Aux. Steaming ☐
	Inspected by			(b) Underway	Speed ______kts
	Meter Type				Shaft ______rpm
	Serial Number				

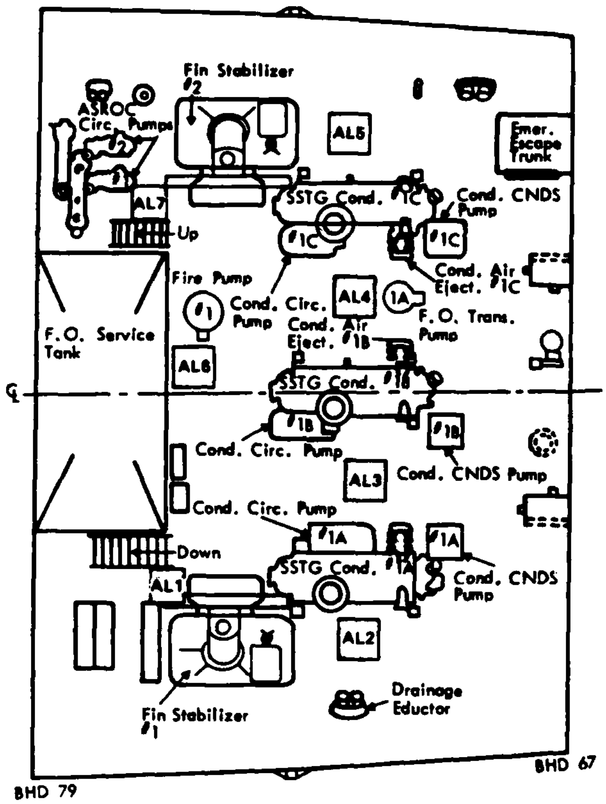
SOUND LEVEL DATA

LOC. CODE	MEAS. LOC.	dBA	INTER ② ?	COMMENTS ③	LOC. CODE	MEAS. LOC.	dBA	INTER. ?	COMMENTS
	AL1					AL6			
	AL2					AL7			
	AL3								
	AL4								
	AL5								

PERSONNEL ASSIGNMENT DATA

LOC. CODE	MEAS. ④ LOC.	BILLET TITLE	RATE ⑤	WEAR ⑥ PROT. ?	WATCH ⑦ STAND ?	HRS./DAY AT LOC. ⑧		COMMENTS ⑨
						WORK	WATCH	

SPACE: Aux. Rm. No. 1 — Lower Level



MACHINERY LINE-UP (OPTIONAL)		
CODE	DESCRIPTION	ON(✓)
	S.S. Turbo Generator No. 1A	
	S.S. Turbo Condensate Air Ejector No. 1A	
	S.S. Turbo Generator No. 1B	
	S.S. Turbo Condensate Air Ejector No. 1B	
	S.S. Turbo Generator No. 1C	
	S.S. Turbo Condensate Air Ejector No. 1C	
	Fire Pump No. 1	
	Fire Stabilizer Power Unit No. 1	
	Fire Stabilizer Power Unit No. 2	
	F.O. Transfer Pump	
	ASROC Circulation Pump	
	Drainage Eductor	

DEFINITION OF PERSONNEL RATES

RATE	RATE DESCRIPTION	DIVISION
MMC	Machinist Mate - Chief	A
MM1	Machinist Mate - 1st Class	A
MM2	Machinist Mate - 2nd Class	A
MM3	Machinist Mate - 3rd Class	A
MMFN	Machinist Mate - Fireman	A
FN	Fireman	A
BTCM	Boiler Tender - Master Chief	B
BT1	Boiler Tender - 1st Class	B
BT2	Boiler Tender - 2nd Class	B
BT3	Boiler Tender - 3rd Class	B
BTFN	Boiler Tender - Fireman	B
EMC	Electrician Mate - Chief	E
EM1	Electrician Mate - 1st Class	E
EM2	Electrician Mate - 2nd Class	E
EM3	Electrician Mate - 3rd Class	E
EMFN	Electrician Mate - Fireman	E
MMCS	Machinist Mate - Senior Chief	M
MM1	Machinist Mate - 1st Class	M
MM2	Machinist Mate - 2nd Class	M
MM3	Machinist Mate - 3rd Class	M
MMFN	Machinist Mate - Fireman	M
FN	Fireman	M

DEFINITIONS & AMPLIFICATIONS

① Readiness	Cond. I - General Quarters Cond. III - Wartime Steaming Cond. IV - Peacetime Steaming Cond. V - In-Port
② Inter. ?	Stands for "is the noise level intermittent?" The question mark (?) requires a "yes" or "no" answer. Intermittent noise is defined as the sound generated by machinery which is cycled on and off and results in large fluctuations in noise levels (more than 5 dBA).
③ Comments	Should be used to note faulty machinery or any other factor that, by inspection, may be responsible for an unusual noise environment at the measurement location.
④ Meas. Loc.	Enter the sound level measurement symbol which is located closest to the individual's position (see Figure).
⑤ Rate	Enter individual's rate abbreviation as shown on the personnel rate table; i.e. Boiler Tender, First Class-BT1.
⑥ Wear Prot. ?	Stands for "is the individual wearing personal hearing protection?" such as earplugs or earmuffs. The question mark (?) requires an "yes" or "no" answer.
⑦ Watch Stand ?	Stands for "is the individual a watch stander or a watch stander trainee?". The question mark (?) requires a "yes" or "no" answer.
⑧ Hrs/Day at Loc.	Enter the number of hours (to closest ¼ hour) that the individual works at location. If answer is "yes" to ⑦ enter number of hours spent as a watch stander at location.
⑨ Comments	Should be used to describe work task when appropriate.

SOUND SURVEY FORM

CODE	GENERAL INFORMATION		CODE	OPERATING CONDITIONS	
	Ship's Class	FF1052 KNOX		Readiness ①	Cond. I ☐ Cond. III ☐
	Space Surveyed	Aux. Rm. #1, Upper Level			Cond. IV ☐ Cond. V ☐
	Ship's Name			Operating Mode	
	Survey Date	/ /		(a) In-Port	Cold Iron ☐
	Time of Day				Aux. Steaming ☐
	Inspected by			(b) Underway	Speed ____ kts
	Meter Type				Shaft ____ rpm
	Serial Number				

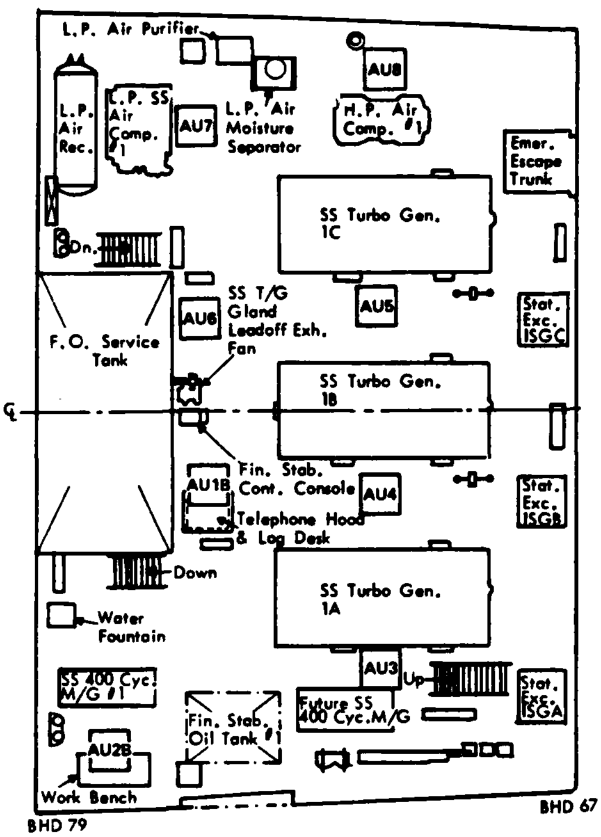
SOUND LEVEL DATA

LOC. CODE	MEAS. LOC.	dBA	INTER ② ?	COMMENTS ③	LOC. CODE	MEAS. LOC.	dBA	INTER. ?	COMMENTS
	AU1B					AU6			
	AU2B					AU7			
	AU 3					AU8			
	AU4								
	AU 5								

PERSONNEL ASSIGNMENT DATA

LOC. CODE	MEAS. ④ LOC.	BILLET TITLE	RATE ⑤	WEAR ⑥ PROT. ?	WATCH ⑦ STAND ?	HRS./DAY AT LOC. ⑧ WORK	WATCH	COMMENTS ⑨

SPACE: Auxiliary Rm. #1, Upper Level



MACHINERY LINE-UP (OPTIONAL)

CODE	DESCRIPTION	ON(✓)
	S.S. Turbo Generator 1A	
	S.S. Turbo Generator 1B	
	S.S. Turbo Generator 1C	
	S.S. 400 Cycle Motor Generator No. 1	
	L.P. Air Compressor No. 1	
	H.P. Air Compressor No. 2	

DEFINITION OF PERSONNEL RATES

RATE	RATE DESCRIPTION	DIVISION
MMC	Machinist Mate - Chief	A
MM1	Machinist Mate - 1st Class	A
MM2	Machinist Mate - 2nd Class	A
MM3	Machinist Mate - 3rd Class	A
MMFN	Machinist Mate - Fireman	A
FN	Fireman	A
BTCM	Boiler Tender - Master Chief	B
BT1	Boiler Tender - 1st Class	B
BT2	Boiler Tender - 2nd Class	B
BT3	Boiler Tender - 3rd Class	B
BTFN	Boiler Tender - Fireman	B
EMC	Electrician Mate - Chief	E
EM1	Electrician Mate - 1st Class	E
EM2	Electrician Mate - 2nd Class	E
EM3	Electrician Mate - 3rd Class	E
EMFN	Electrician Mate - Fireman	E
MMCS	Machinist Mate - Senior Chief	M
MM1	Machinist Mate - 1st Class	M
MM2	Machinist Mate - 2nd Class	M
MM3	Machinist Mate - 3rd Class	M
MMFN	Machinist Mate - Fireman	M
FN	Fireman	M

DEFINITIONS & AMPLIFICATIONS

① Readiness	Cond. I - General Quarters Cond. III - Wartime Steaming Cond. IV - Peacetime Steaming Cond. V - In-Port
② Inter. ?	Stands for "is the noise level intermittent?" The question mark (?) requires a "yes" or "no" answer. Intermittent noise is defined as the sound generated by machinery which is cycled on and off and results in large fluctuations in noise levels (more than 5 dBA).
③ Comments	Should be used to note faulty machinery or any other factor that, by inspection, may be responsible for an unusual noise environment at the measurement location.
④ Meas. Loc.	Enter the sound level measurement symbol which is located closest to the individual's position (see Figure).
⑤ Rate	Enter individual's rate abbreviation as shown on the personnel rate table; i.e. Boiler Tender, First Class-BT1.
⑥ Wear Prot. ?	Stands for "is the individual wearing personal hearing protection?" such as earplugs or earmuffs. The question mark (?) requires an "yes" or "no" answer.
⑦ Watch Stand ?	Stands for "is the individual a watch stander or a watch stander trainee?". The question mark (?) requires a "yes" or "no" answer.
⑧ Hrs/Day at Loc.	Enter the number of hours (to closest ¼ hour) that the individual works at location. If answer is "yes" to ⑦ enter number of hours spent as a watch stander at location.
⑨ Comments	Should be used to describe work task when appropriate.

FF1052 Class

SOUND SURVEY FORM

CODE	GENERAL INFORMATION		CODE	OPERATING CONDITIONS	
	Ship's Class	FF1052 KNOX		Readiness ①	Cond. I ☐ Cond. III ☐
	Space Surveyed	Aux. Rm. No. 2			Cond. IV ☐ Cond. V ☐
	Ship's Name			Operating Mode	
	Survey Date	/ /		(a) In-Port	Cold Iron ☐
	Time of Day				Aux. Steaming ☐
	Inspected by			(b) Underway	Speed ______kts
	Meter Type				Shaft ______rpm
	Serial Number			Diesel Generator	On ☐ Off ☐

SOUND LEVEL DATA

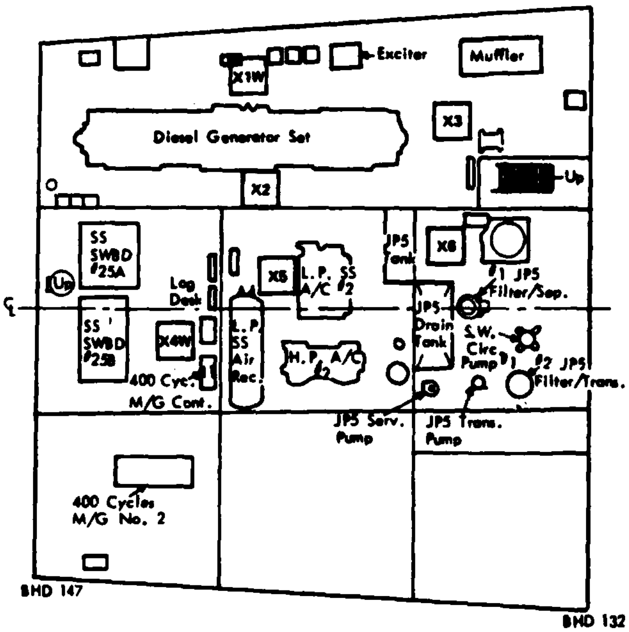
LOC. CODE	MEAS. LOC.	dBA	INTER ② ?	COMMENTS ③	LOC. CODE	MEAS. LOC.	dBA	INTER. ?	COMMENTS
	X1W					X6			
	X2								
	X3								
	X4W								
	X5								

PERSONNEL ASSIGNMENT DATA

LOC. CODE	MEAS. ④ LOC.	BILLET TITLE	RATE ⑤	WEAR ⑥ PROT. ?	WATCH ⑦ STAND ?	HRS./DAY AT LOC. ⑧		COMMENTS ⑨
						WORK	WATCH	

FF1052 Class

SPACE: Aux. Rm. No. 2



MACHINERY LINE-UP (OPTIONAL)

CODE	DESCRIPTION	ON(√)
	S.S. Diesel Generator	
	S.S. Diesel Generator S.W. Circulation Pump	
	Fire Pump No. 4	
	JP-5 Transfer Pump No. 1	
	JP-5 Service Pump No. 1	
	JP-5 Service Filter/Separator No. 1	
	L.P. S.S. Air Compressor	
	H.P. S.S. Air Compressor	
	S.S. 400 Cycle Motor Generator No. 2	

DEFINITION OF PERSONNEL RATES

RATE	RATE DESCRIPTION	DIVISION
MMC	Machinist Mate - Chief	A
MM1	Machinist Mate - 1st Class	A
MM2	Machinist Mate - 2nd Class	A
MM3	Machinist Mate - 3rd Class	A
MMFN	Machinist Mate - Fireman	A
FN	Fireman	A
BTCM	Boiler Tender - Master Chief	B
BT1	Boiler Tender - 1st Class	B
BT2	Boiler Tender - 2nd Class	B
BT3	Boiler Tender - 3rd Class	B
BTFN	Boiler Tender - Fireman	B
EMC	Electrician Mate - Chief	E
EM1	Electrician Mate - 1st Class	E
EM2	Electrician Mate - 2nd Class	E
EM3	Electrician Mate - 3rd Class	E
EMFN	Electrician Mate - Fireman	E
MMCS	Machinist Mate - Senior Chief	M
MM1	Machinist Mate - 1st Class	M
MM2	Machinist Mate - 2nd Class	M
MM3	Machinist Mate - 3rd Class	M
MMFN	Machinist Mate - Fireman	M
FN	Fireman	M

DEFINITIONS & AMPLIFICATIONS

1 Readiness	Cond. I - General Quarters Cond. III - Wartime Steaming Cond. IV - Peacetime Steaming Cond. V - In-Port
2 Inter. ?	Stands for "Is the noise level intermittent?" The question mark (?) requires a "yes" or "no" answer. Intermittent noise is defined as the sound generated by machinery which is cycled on and off and results in large fluctuations in noise levels (more than 5 dBA).
3 Comments	Should be used to note faulty machinery or any other factor that, by inspection, may be responsible for an unusual noise environment at the measurement location.
4 Meas. Loc.	Enter the sound level measurement symbol which is located closest to the individual's position (see Figure).
5 Rate	Enter individual's rate abbreviation as shown on the personnel rate table; i.e. Boiler Tender, First Class-BT1.
6 Wear Prot. ?	Stands for "Is the individual wearing personal hearing protection?" such as earplugs or earmuffs. The question mark (?) requires an "yes" or "no" answer.
7 Watch Stand ?	Stands for "Is the individual a watch stander or a watch stander trainee?". The question mark (?) requires a "yes" or "no" answer.
8 Hrs/Day at Loc.	Enter the number of hours (to closest ½ hour) that t. individual works at location. If answer is "yes" to 7 enter number of hours spent as a watch stander at location.
9 Comments	Should be used to describe work task when appropriate.

SOUND SURVEY FORM

CODE	GENERAL INFORMATION		CODE	OPERATING CONDITIONS	
	Ship's Class	FF1052 KNOX		Readiness ①	Cond. I ☐ Cond. III ☐
	Space Surveyed	FDB Rm. 1A			Cond. IV ☐ Cond. V ☐
	Ship's Name			Operating Mode	
	Survey Date	/ /		(a) In-Port	Cold Iron ☐
	Time of Day				Aux. Steaming ☐
	Inspected by			(b) Underway	Speed ______ kts
	Meter Type				Shaft ______ rpm
	Serial Number				

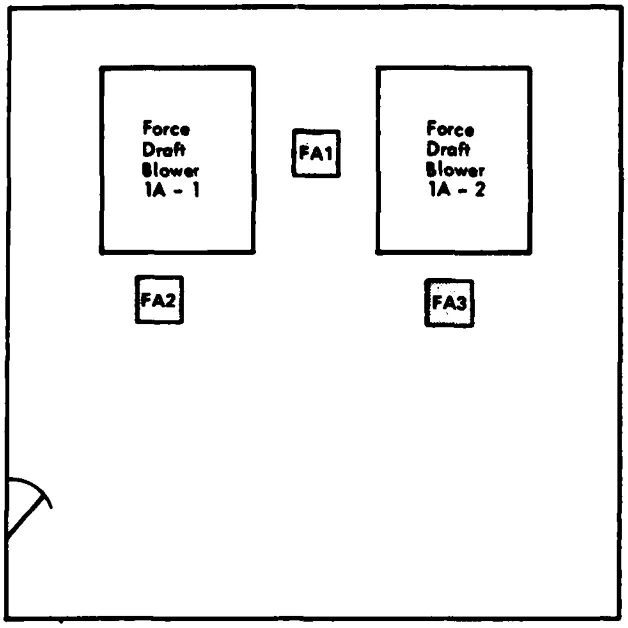
SOUND LEVEL DATA

LOC. CODE	MEAS. LOC.	dBA	INTER ② ?	COMMENTS ③	LOC. CODE	MEAS. LOC.	dBA	INTER. ?	COMMENTS
	FA 1								
	FA 2								
	FA 3								

PERSONNEL ASSIGNMENT DATA

LOC. CODE	MEAS. ④ LOC.	BILLET TITLE	RATE ⑤	WEAR ⑥ PROT. ?	WATCH ⑦ STAND ?	HRS./DAY AT LOC. ⑧		COMMENTS ⑨
						WORK	WATCH	

SPACE: FDB Rm. 1A



MACHINERY LINE-UP (OPTIONAL)

CODE	DESCRIPTION	ON(√)
	Force Draft Blower 1A-1	
	Force Draft Blower 1A-2	

DEFINITION OF PERSONNEL RATES

RATE	RATE DESCRIPTION	DIVISION
MMC	Machinist Mate - Chief	A
MM1	Machinist Mate - 1st Class	A
MM2	Machinist Mate - 2nd Class	A
MM3	Machinist Mate - 3rd Class	A
MMFN	Machinist Mate - Fireman	A
FN	Fireman	A
BTCM	Boiler Tender - Master Chief	B
BT1	Boiler Tender - 1st Class	B
BT2	Boiler Tender - 2nd Class	B
BT3	Boiler Tender - 3rd Class	B
BTFN	Boiler Tender - Fireman	B
EMC	Electrician Mate - Chief	E
EM1	Electrician Mate - 1st Class	E
EM2	Electrician Mate - 2nd Class	E
EM3	Electrician Mate - 3rd Class	E
EMFN	Electrician Mate - Fireman	E
MMCS	Machinist Mate - Senior Chief	M
MM1	Machinist Mate - 1st Class	M
MM2	Machinist Mate - 2nd Class	M
MM3	Machinist Mate - 3rd Class	M
MMFN	Machinist Mate - Fireman	M
FN	Fireman	M

DEFINITIONS & AMPLIFICATIONS

① Readiness	Cond. I - General Quarters Cond. III - Wartime Steaming Cond. IV - Peacetime Steaming Cond. V - In-Port
② Inter. ?	Stands for "Is the noise level intermittent?" The question mark (?) requires a "yes" or "no" answer. Intermittent noise is defined as the sound generated by machinery which is cycled on and off and results in large fluctuations in noise levels (more than 5 dBA).
③ Comments	Should be used to note faulty machinery or any other factor that, by inspection, may be responsible for an unusual noise environment at the measurement location.
④ Meas. Loc.	Enter the sound level measurement symbol which is located closest to the individual's position (see Figure).
⑤ Rate	Enter individual's rate abbreviation as shown on the personnel rate table; i.e. Boiler Tender, First Class-BT1.
⑥ Wear Prot. ?	Stands for "Is the individual wearing personal hearing protection?" such as earplugs or earmuffs. The question mark (?) requires an "yes" or "no" answer.
⑦ Watch Stand ?	Stands for "Is the individual a watch stander or a watch stander trainee?". The question mark (?) requires a "yes" or "no" answer.
⑧ Hrs/Day at Loc.	Enter the number of hours (to closest ¼ hour) that the individual works at location. If answer is "yes" to ⑦ enter number of hours spent as a watch stander at location.
⑨ Comments	Should be used to describe work task when appropriate.

SOUND SURVEY FORM

CODE	GENERAL INFORMATION		CODE	OPERATING CONDITIONS	
	Ship's Class	FF1052 KNOX		Readiness ①	Cond. I☐ Cond. III☐
	Space Surveyed	FDB Rm. 1B			Cond. IV☐ Cond. V☐
	Ship's Name			Operating Mode	
	Survey Date	/ /		(a) In-Port	Cold Iron ☐
	Time of Day				Aux. Steaming ☐
	Inspected by			(b) Underway	Speed ______ kts
	Meter Type				Shaft ______ rpm
	Serial Number				

SOUND LEVEL DATA

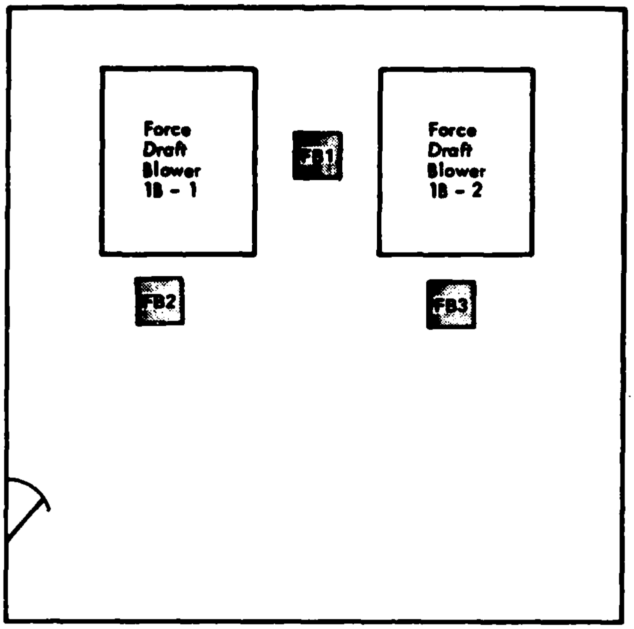
LOC. CODE	MEAS. LOC.	dBA	INTER ② ?	COMMENTS ③	LOC. CODE	MEAS. LOC.	dBA	INTER. ?	COMMENTS
	FB 1								
	FB 2								
	FB 3								

PERSONNEL ASSIGNMENT DATA

LOC. CODE	MEAS. ④ LOC.	BILLET TITLE	RATE ⑤	WEAR ⑥ PROT. ?	WATCH ⑦ STAND ?	HRS./DAY AT LOC. ⑧ WORK	WATCH	COMMENTS ⑨

FF1052 Class

SPACE: FDB Rm. 1B



MACHINERY LINE-UP (OPTIONAL)

CODE	DESCRIPTION	ON(✓)
	Force Draft Blower 1B-1 ✓	
	Force Draft Blower 1B-2 ✓	

DEFINITION OF PERSONNEL RATES

RATE	RATE DESCRIPTION	DIVISION
MMC	Machinist Mate - Chief	A
MM1	Machinist Mate - 1st Class	A
MM2	Machinist Mate - 2nd Class	A
MM3	Machinist Mate - 3rd Class	A
MMFN	Machinist Mate - Fireman	A
FN	Fireman	A
BTCM	Boiler Tender - Master Chief	B
BT1	Boiler Tender - 1st Class	B
BT2	Boiler Tender - 2nd Class	B
BT3	Boiler Tender - 3rd Class	B
BTFN	Boiler Tender - Fireman	B
EMC	Electrician Mate - Chief	E
EM1	Electrician Mate - 1st Class	E
EM2	Electrician Mate - 2nd Class	E
EM3	Electrician Mate - 3rd Class	E
EMFN	Electrician Mate - Fireman	E
MMCS	Machinist Mate - Senior Chief	M
MM1	Machinist Mate - 1st Class	M
MM2	Machinist Mate - 2nd Class	M
MM3	Machinist Mate - 3rd Class	M
MMFN	Machinist Mate - Fireman	M
FN	Fireman	M

DEFINITIONS & AMPLIFICATIONS

① Readiness	Cond. I - General Quarters Cond. III - Wartime Steaming Cond. IV - Peacetime Steaming Cond. V - In-Port
② Inter. ?	Stands for "is the noise level intermittent?" The question mark (?) requires a "yes" or "no" answer. Intermittent noise is defined as the sound generated by machinery which is cycled on and off and results in large fluctuations in noise levels (more than 5 dBA).
③ Comments	Should be used to note faulty machinery or any other factor that, by inspection, may be responsible for an unusual noise environment at the measurement location.
④ Meas. Loc.	Enter the sound level measurement symbol which is located closest to the individual's position (see Figure).
⑤ Rate	Enter individual's rate abbreviation as shown on the personnel rate table; i.e. Boiler Tender, First Class-BT1.
⑥ Wear Prot. ?	Stands for "is the individual wearing personal hearing protection?" such as earplugs or earmuffs. The question mark (?) requires an "yes" or "no" answer.
⑦ Watch Stand ?	Stands for "is the individual a watch stander or a watch stander trainee?". The question mark (?) requires a "yes" or "no" answer.
⑧ Hrs/Day at Loc.	Enter the number of hours (to closest ¼ hour) that the individual works at location. If answer is "yes" to ⑦ enter number of hours spent as a watch stander at location.
⑨ Comments	Should be used to describe work task when appropriate.

FF1052 Class

SOUND SURVEY FORM

CODE	GENERAL INFORMATION		CODE	OPERATING CONDITIONS	
	Ship's Class	FF1052 KNOX		Readiness ①	Cond. I☐ Cond. III☐
	Space Surveyed	After Steering			Cond. IV☐ Cond. V☐
	Ship's Name			Operating Mode	
	Survey Date	/ /		(a) In-Port	Cold Iron ☐
	Time of Day				Aux. Steaming ☐
	Inspected by			(b) Underway	Speed ______kts
	Meter Type				Shaft ______rpm
	Serial Number				

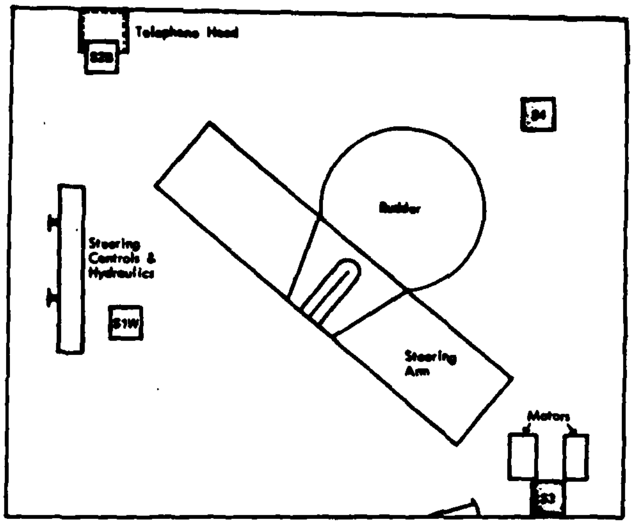
SOUND LEVEL DATA

LOC. CODE	MEAS. LOC.	dBA	INTER ② ?	COMMENTS ③	LOC. CODE	MEAS. LOC.	dBA	INTER. ?	COMMENTS
	S1W								
	S2B								
	S3								
	S4								

PERSONNEL ASSIGNMENT DATA

LOC. CODE	MEAS. ④ LOC.	BILLET TITLE	RATE ⑤	WEAR ⑥ PROT. ?	WATCH ⑦ STAND ?	HRS./DAY AT LOC. ⑧		COMMENTS ⑨
						WORK	WATCH	

SPACE: After Steering



MACHINERY LINE-UP (OPTIONAL)

CODE	DESCRIPTION	ON(✓)
	Steering Gear Motor No. 1	
	Steering Gear Motor No. 2	

DEFINITION OF PERSONNEL RATES

RATE	RATE DESCRIPTION	DIVISION
MMC	Machinist Mate - Chief	A
MM1	Machinist Mate - 1st Class	A
MM2	Machinist Mate - 2nd Class	A
MM3	Machinist Mate - 3rd Class	A
MMFN	Machinist Mate - Fireman	A
FN	Fireman	A
BTCM	Boiler Tender - Master Chief	B
BT1	Boiler Tender - 1st Class	B
BT2	Boiler Tender - 2nd Class	B
BT3	Boiler Tender - 3rd Class	B
BTFN	Boiler Tender - Fireman	B
EMC	Electrician Mate - Chief	E
EM1	Electrician Mate - 1st Class	E
EM2	Electrician Mate - 2nd Class	E
EM3	Electrician Mate - 3rd Class	E
EMFN	Electrician Mate - Fireman	E
MMCS	Machinist Mate - Senior Chief	M
MM1	Machinist Mate - 1st Class	M
MM2	Machinist Mate - 2nd Class	M
MM3	Machinist Mate - 3rd Class	M
MMFN	Machinist Mate - Fireman	M
FN	Fireman	M

DEFINITIONS & AMPLIFICATIONS

1 Readiness	Cond. I - General Quarters Cond. III - Wartime Steaming Cond. IV - Peacetime Steaming Cond. V - In-Port
2 Inter. ?	Stands for "Is the noise level intermittent?" The question mark (?) requires a "yes" or "no" answer. Intermittent noise is defined as the sound generated by machinery which is cycled on and off and results in large fluctuations in noise levels (more than 5 dBA).
3 Comments	Should be used to note faulty machinery or any other factor that, by inspection, may be responsible for an unusual noise environment at the measurement location.
4 Meas. Loc.	Enter the sound level measurement symbol which is located closest to the individual's position (see Figure).
5 Rate	Enter individual's rate abbreviation as shown on the personnel rate table; i.e. Boiler Tender, First Class-BT1.
6 Wear Prot. ?	Stands for "Is the individual wearing personal hearing protection?" such as earplugs or earmuffs. The question mark (?) requires an "yes" or "no" answer.
7 Watch Stand ?	Stands for "Is the individual a watch stander or a watch stander trainee?". The question mark (?) requires a "yes" or "no" answer.
8 Hrs/Day at Loc.	Enter the number of hours (to closest ¼ hour) that the individual works at location. If answer is "yes" to 7 enter number of hours spent as a watch stander at location.
9 Comments	Should be used to describe work task when appropriate.

APPENDIX C

Shipboard Sound Survey Procedure

Project No. 09168 BOLT BERANEK AND NEWMAN INC.

SHIPBOARD SOUND SURVEY PROCEDURE

Prepared under Contract No. N00014-78-C-0408
"Development and Validation of Shipboard Noise Exposure Data Aquisition Procedures"

For the:

Naval Medical Research and Development Command
National Naval Medical Center

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1. OBJECTIVE

The objective of this shipboard sound survey procedure is to provide for a uniform method of sound level data collection which is consistent with the requirements of a Navy Noise Exposure Data Management System under study.

2. APPLICABILITY SCOPE AND LIMITATIONS

This sound survey procedure is limited to the FF1052 class (Knox) ships and further to the engineering spaces only. In its current version, the procedure will be implemented for a three month period by the EPMU-2 (Norfolk, Va.) and EPMU-5 (San Diego, Ca.) units during routine inspections of the Knox class. The data gathered will be used to examine the validity and accuracy of the noise exposure managment system under study. Only the In-Port-Auxiliary Steaming ship operating condition will be surveyed although the procedure is designed to be applicable to any operating mode.

3. SOUND SURVEY FORMS

The Sound Survey Forms, (SSF) developed incorporate all of the data routinely collected by the EPMU's and has been designed to follow normal survey procedures. Each Form is printed front and back on a single page as shown in Figure 1 and is divided into two parts:

1. Front Side: the front side of the page contains all of the data entries required in the survey.
2. Back Side: the back side of the page contains support information to the survey procedure, symbol definitions and clarifications.

Each sound survey form is specific as to: a) the ship class and b) the ship space. Therefore, in the case of the FF.1052 (Knox) class, a full compliment of Sound Survey Forms, one for each engineering space and level, is provided and should be used (12 pages in total).

4. Survey Procedure

The front page is divided into four sections as follows:

1. General Information: includes ship, date, inspector, and equipment identification questions.
2. Operating Conditions: defines the ship operating conditions during the survey.
3. Sound Level Data: contains the acoustic (noise) data entries required in each space.
4. Personnel Assignment Data: contains the parameters necessary to describe the personnel time-work task data.

4.1 General Information

- *Ship's Class:* already identified, in this case as FF1052-Knox.
- *Space Surveyed:* already identified, select the Sound Survey Form that corresponds to the space being surveyed.
- *Ship's Name:* enter the name and number of ship being inspected; i.e. U.S. Paul, FF1080.
- *Survey Date:* enter date of survey.
- *Time of Day:* enter time of survey.

SOUND SURVEY FORM

CODE	GENERAL INFORMATION		CODE	OPERATING CONDITIONS	
	Ship's Class	FF1052 KNOX		Readiness ①	Cond. I ☐ Cond. III ☐
	Space Surveyed	Engine Rm. Lower Level			Cond. IV ☐ Cond. V ☐
	Ship's Name			Operating Mode	
	Survey Date	/ /		(a) In-Port	Cold Iron ☐
	Time of Day				Aux. Steaming ☐
	Inspected by			(b) Underway	Speed ______kts
	Meter Type				Shaft ______rpm
	Serial Number				

SOUND LEVEL DATA

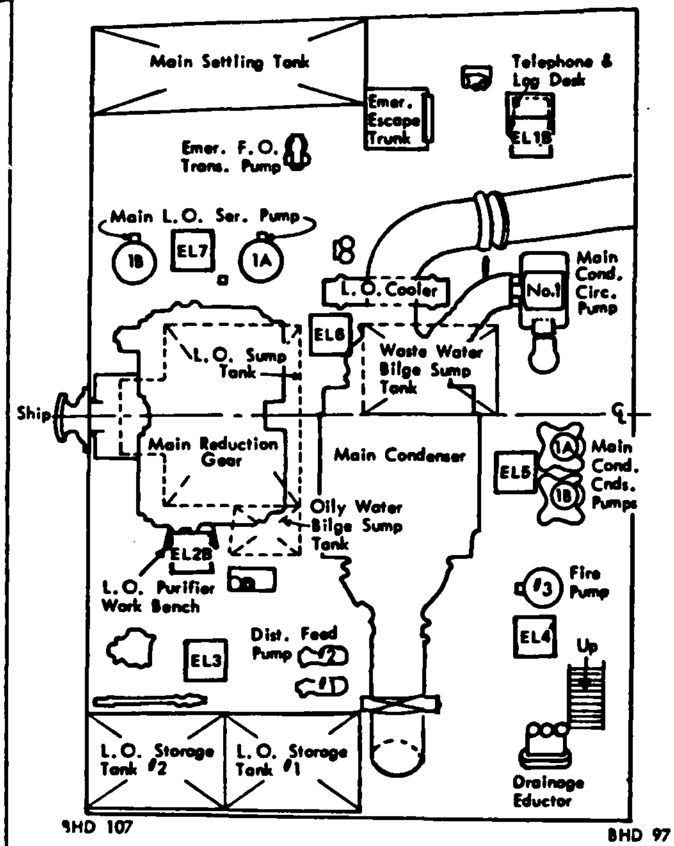
LOC. CODE	MEAS. LOC.	dBA	INTER ② ?	COMMENTS ③	LOC. CODE	MEAS. LOC.	dBA	INTER. ?	COMMENTS
	EL1B					EL6			
	EL2B					EL7			
	EL3								
	EL4								
	EL5								

PERSONNEL ASSIGNMENT DATA

LOC. CODE	MEAS. ④ LOC.	BILLET TITLE	RATE ⑤	WEAR ⑥ PROT. ?	WATCH ⑦ STAND ?	HRS./DAY AT LOC. ⑧		COMMENTS ⑨
						WORK	WATCH	

· FF1052 Class

SPACE: Engine Rm. Lower Level



MACHINERY LINE-UP (OPTIONAL)

CODE	DESCRIPTION	ON(✓)
	Main Reduction Gear	
	Main Condensate Pump 1A	
	Main Condensate Pump 1B	
	Fire Pump No. 3	
	Main Condensate Circulation Pump No. 1	
	Main L.O. Service Pump 1A	
	Main L.O. Service Pump 1B	
	L.O. Purifier No. 1	
	Distillate Feed Pump No. 1	
	Distillate Feed Pump No. 2	
	Drainage Eductor	
	Emergency F.O. Transfer Pump	

DEFINITION OF PERSONNEL RATES

RATE	RATE DESCRIPTION	DIVISION
MMC	Machinist Mate - Chief	A
MM1	Machinist Mate - 1st Class	A
MM2	Machinist Mate - 2nd Class	A
MM3	Machinist Mate - 3rd Class	A
MMFN	Machinist Mate - Fireman	A
FN	Fireman	A
BTCM	Boiler Tender - Master Chief	B
BT1	Boiler Tender - 1st Class	B
BT2	Boiler Tender - 2nd Class	B
BT3	Boiler Tender - 3rd Class	B
BTFN	Boiler Tender - Fireman	B
EMC	Electrician Mate - Chief	E
EM1	Electrician Mate - 1st Class	E
EM2	Electrician Mate - 2nd Class	E
EM3	Electrician Mate - 3rd Class	E
EMFN	Electrician Mate - Fireman	E
MMCS	Machinist Mate - Senior Chief	M
MM1	Machinist Mate - 1st Class	M
MM2	Machinist Mate - 2nd Class	M
MM3	Machinist Mate - 3rd Class	M
MMFN	Machinist Mate - Fireman	M
FN	Fireman	M

DEFINITIONS & AMPLIFICATIONS

① Readiness	Cond. I - General Quarters Cond. III - Wartime Steaming Cond. IV - Peacetime Steaming Cond. V - In-Port
② Inter. ?	Stands for "Is the noise level intermittent?" The question mark (?) requires a "yes" or "no" answer. Intermittent noise is defined as the sound generated by machinery which is cycled on and off and results in large fluctuations in noise levels (more than 5 dBA).
③ Comments	Should be used to note faulty machinery or any other factor that, by inspection, may be responsible for an unusual noise environment at the measurement location.
④ Meas. Loc.	Enter the sound level measurement symbol which is located closest to the individual's position (see Figure).
⑤ Rate	Enter individual's rate abbreviation as shown on the personnel rate table; i.e. Boiler Tender, First Class-BT1.
⑥ Wear Prot. ?	Stands for "Is the individual wearing personal hearing protection?" such as earplugs or earmuffs. The question mark (?) requires an "yes" or "no" answer.
⑦ Watch Stand ?	Stands for "Is the individual a watch stander or a watch stander trainee?". The question mark (?) requires a "yes" or "no" answer.
⑧ Hrs/Day at Loc.	Enter the number of hours (to closest ½ hour) that the individual works at location. If answer is "yes" to ⑦ enter number of hours spent as a watch stander at location.
⑨ Comments	Should be used to describe work task when appropriate.

- *Inspected by:* enter initials and last name of individual performing the survey.
- *Meter Type:* enter the make and model number of sound survey meter being used, i.e. General Radio 1565B.
- *Serial Number:* enter serial number of sound survey meter used.

4.2 Operating Conditions

- *Readiness:* enter the ship's readiness condition by checking one of the four condition boxes. The superscript 1 refers to the Definitions and Amplifications section contained on the back side of the form.
- *Operating Mode:* the operating mode of the ship may be either a) In-Port or b) Underway as shown. If In-Port, check either Cold Iron or Auxiliary Steaming as appropriate. If Underway, enter the speed and shaft rpm.

  Note that this program is concerned only with the Auxiliary Steaming operating mode, therefore all data collected should be under this operating condition.
- *Praire Masker:* in fire room spaces only. This system is used infrequently and only in the Underway mode. Since it's operation affects substantially the noise levels measured in these spaces, it is necessary to identify if the system is "on" or "off".
- *Diesel Generator:* in auxiliary room No. 2 only. The operation of the diesel generator is infrequent and affects substaintially the noise levels measured in this space. Therefore, it is necessary to identify if the system is "on" or "off".

4.3 Sound Level Data

- *Measurement Locations:* already identified. Locate the measurement location identified by referring to the space floor plan contained on the back side of the survey form.

  The measurement location symbol is shown in a square. The symbols used indicate the compartment, the level, the location number and whatever the location is a watch station (W) or a work bench or telephone (B) area, as follows:

  EU2W
  W → Watch Station
  2 → Second Location
  U → Upper Level
  E → Engine Room

- *dBA:* enter the measured "A-weighted" sound level. The measurement should be performed at ear height. Some spatial averaging should be obtained by slowly moving the meter horizontally from side to side (see Section 5 for further instructions).

- *Inter?:* Stands for "is the noise level intermittent?". The question mark (?) requires a "yes" or "no" answer. Intermittent noise is defined as the sound generated by machinery which are cycled on and off and results in large fluctuations in noise levels (more than 5 dBA).

- *Comments:* use to note any faulty machinery or any other factor that, by inspection, may be responsible for an unusual noise enviroment at the measurement location.

  Should be also used to note large temporal or spatial noise level fluctuations (see Section 5).

4.4 Personnel Assignment Data

The objective of this section is to acquire personnel work assignment data that may be used to establish a statistical time-motion description of all engineering personnel work assignments on the ship. The key to this end is the identification of the engineering space personnel and the time spent at each of sound measurement locations surveyed. This type of information has not been previously collected by EPMU personnel and represents an addition to present practice. During the survey procedure, and more specifically while in the process of conducting the sound level measurements, the inspector will question any engineering personnel present in the space being surveyed. The personnel questioned will be limited to those individuals found during the performance of the sound level survey and no effort should be expended to locate all engineering personnel. The following information should be recorded:

- *Meas. Loc.:* enter the sound measurement location symbol from the Sound Level Data portion of the form which is closest to the individual's position. The sound measurement locations are shown on the space floor plan. These inputs establish a unique correlation between a position in the space (and therefore noise level) and the individual.
- *Billet Title:* ask the individual and enter his billet title.
- *Rate:* ask the individual and enter his rate. The definition of personnel rates with their corresponding abbreviations are provided on the back side of the form.
- *Wear Prot.?:* stands for "is the individual wearing personal

hearing protection" such as earplugs or earmuffs. The question mark (?) requires a "yes" or "no" answer.

- *Watch Stand?:* stands for "is the individual a watch stander or a watch stander trainee?". Note that the question pertains only to the work assignment the individual is performing at the time. The question mark (?) requires a "yes" or "no" answer.

- *Hrs./day at Loc.:* enter the number of hours (to the closest 1/4 of an hour) that the individual works at location under the work column. If the answer to the previous question is "yes" (the individual is a watch stander or watch stander trainee) then enter the number of hours as a watch stander.

- *Comments:* when the individual is performing work tasks, describe his function as appropriate, i.e. fixing oil pump, painting, etc.

Note: all numbers in ◯ refer to the Definitions and Amplifications section presented on the back of the form. This information is provided in an effort to make each form self-explanatory.

The back side of the form contains one additional entry. This entry called "Machinery Line-Up" contains the description of all major machinery units associated with noise generation and deceipted picturally in the floor plan. The inspector is asked (on an optional basis) to identify the equipment on-line by a check mark in the appropriate space.

5. Sound Measurement Procedure

In order to ensure a uniform sound level data measurement procedure the following steps should be followed during the survey:

1. Locate measurement location by refering to the space floor plan contained on the back side of the survey form.

2. Using a calibrated sound level meter, measure the average "A-weighted" sound level (dBA) at the measurement location. The meter should be turned on the "A scale" and "slow" response. (The latter applies only to meters having a slow and fast meter averaging networks).

3. The averaging of the sound level data should be made in both the "temporal" and spatial domain. Temporal Averaging is accomplished by visually averaging any meter fluctuation over a period of time (a minimum of 15 seconds). Spatial averaging is accomplished by slowly moving the meter in a horizontal plane from side to side, as shown in Figure 2 and visually averaging any meter fluctuations.

4. If sound level fluctuations exceed ±3 dBA, note so in the comments column, i.e. noise levels fluctuate ±5 dBA.

6. Additional Data Requirements

The above procedures are descriptive of the survey steps which will be followed during routine surveys of this class. For evaluation purposes the time and difficulty of following those steps needs to be assessed. The individual performing the survey should make notes as to the following items:

1. The total time necessary to complete the survey and how that compares to previous procedures.

2. The difficulties encountered in following the procedure. Be specific as to the problem areas so that changes may be designed later.

3. Any other information that can serve to evaluate and improve the procedure.

The above comments and the results of personal debriefings which will be conducted by BBN at the conclusion of the data collection program will be used to assess the practicality of this procedures and to the develop any changes and modifications.

As was discussed previously, the collection of personnel assignment data is a new and key part of the noise exposure data system. Since during the three month period of this survey only a limited number of ships will be surveyed, it is necessary to aquire further data on that subject. Specifically, the individual assignments of all engineering personnel during a one day period will have to be assessed. Thus, although the normal procedure relied on the statistics of many ship measurements to describe the daily work assignment of various personnel ratings, this study will require a full documentation on personnel movements in order to evaluate the accuracy of the method with a limited data base.

The method necessary to aquire this information is discussed below and utilizes the form shown on Figure 3 which is filled with an example.

1. Locate, if possible, all engineering personnel as described in the Definitions of Personnel Rates presented on the back of the Sound Survey Form. Each individual should be asked the following questions:

   a. Billet Title
   b. Rate
   c. Note if he is wearing hearing protective equipment.

Note: All questions as to personnel movements will be addressed to the previous day. This will maximize accurate recolection and ensure that a full workday is included.

FF1052 Cl[illegible]

WORK ASSIGNMENT DATA

Ship's Name: [illegible]
Survey Date: No. 0, 1978

Billet Title	Rate	Wear Hearing Protect.	Watch Stander		Work Tasks		Total Hrs. Work Day
			Hrs.	Location	Hrs.	Locations	
25104	BTFN	Yes - No	4.0	ETIW	3.0; 4.0; 1.0;	FL7; FU6; FS1	12.0
25108	BTFN	Yes - No	8.0	FL1W	–	–	8.0
24907	BT3	Yes - No	–	–	1.0; 2.0; 0.5; 0.5; 2.0; 2.0;	FL6; FL38; FL10; FL9; FU5; FU7;	8.0
		Yes - No					
		Yes - No					
		Yes - No					
		Yes - No					
		Yes - No					
		Yes - No					
		Yes - No					
		Yes - No					
		Yes - No					
		Yes - No					
		Yes - No					
		Yes - No					
		Yes - No					
		Yes - No					
		Yes - No					
		Yes - No					
		Yes - No					
		Yes - No					
		Yes - No					
		Yes - No					
		Yes - No					
		Yes - No					
		Yes - No					
		Yes - No					

EXAMPLE

FIGURE 3 - EXAMPLE OF PERSONNEL WORK ASSIGNMENT DATA AQUISITION

2. Was he a "Watch Stander"? If yes, enter the number of hours spent and the measurement location code closest to the watch station.

Note: Since all watch stations have been identified on the Sound Survey Forms, the inspector should be able to identify the watch station by refering to the proper floor plan.

3. Ask the individual to recount his work duties on the previous day exclusive of the watch stander assignment. Similarly to the watch stander procedure, enter the number of hours (to the closest 1/2 hour) and measurement location code for each work area. In the first line of our example, the BTFN Rate spent 3.0 hours at location FL7, 4.0 hours at location FV6, and 1.0 hours at location FS1. Entries should be made consecutively as shown in the example with the total number of hours in the workday corresponding to the addition of the individual's watch stander and other work task duties.

APPENDIX D

Personnel Work Assignments

The decimal numbers in the table are the hours assigned to each location for the particular personnel grade. The integer numbers in brackets are the number of personnel in the particular grade who were assigned to the location.

MEAN ASSIGNMENT TIMES BY SHIP NUMBER (HRS)

PERS. GRADE	ASSIGNED LOCATION	FF-1083	FF-1065	FF-1084	FF-1080	FF-1091	FF-1097	FF-1094	FF-1085	FF-1092	FF-1062	FF-1077	FF-1075
BT2	FUIN	7.5(1)	0.0(0)	0.0(0)	0.0(0)	8.7(3)	3.3(2)	7.0(2)	0.0(0)	10.0(2)	0.0(0)	6.1(4)	9.0(2)
	FRT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	3.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0	4.0(1)	2.0(4)	8.0(1)
	FUT	0.0(0)	2.0(1)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	8.0(1)	0.0(0)	0.0(0)
	FU7	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU1	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.6(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FLIN	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.8(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU38	0.0(0)	6.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU2N	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	1.5(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FS3	2.5(1)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU10	4.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FLT	0.0(0)	0.0(0)	2.0(1)	0.0(0)	2.0(1)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FST	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU8	1.5(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FL3N	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FS1	0.0(0)	0.0(0)	0.0(0)	4.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FL5	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU6	2.0(1)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FS2	3.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FL7	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FL6	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ERT	4.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EL1B	6.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
BT1	FUIN	0.0(0)	5.0(1)	5.0(1)	0.0(0)	8.1(2)	0.0(0)	10.5(1)	.8(2)	0.0(0)	0.0(0)	0.0(0)	6.0(1)
	FRT	0.0(0)	0.0(0)	2.0(1)	0.0(0)	3.0(1)	9.5(1)	0.0(0)	3.0(1)	0.0(0)	7.0(1)	0.0(0)	0.0(0)
	FLIN	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	6.0(1)	0.0(0)	0.0(0)	0.0(0)
	FL10	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	6.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ES2	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ES4	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.3(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ALT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ESIN	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.1(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FUT	0.0(0)	3.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FLT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EST	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AL6	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EL7	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
BTC	ESIN	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)
	FUT	0.0(0)	4.0(1)	.5(1)	0.0(0)	0.0(0)	3.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FST	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	3.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FLT	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	3.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU1N	0.0(0)	2.0(1)	2.0(2)	4.0(1)	9.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FRT	0.0(0)	0.0(0)	.5(1)	4.0(1)	.6(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FS1	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU2N	0.0(0)	1.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)

PERS. GRADE	ASSIGNED LOCATION	FF-1053	FF-1065	FF-1086	FF-1090	FF-1091	FF-1097	FF-1094	FF-1085	FF-1092	FF-1081	FF-1097	FF-1075
		MEAN ASSIGNMENT TIMES BY SHIP NUMBER (HRS)											
BTFN	FU1W	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	4.0(1)	12.0(1)	0.0(0)	0.0(0)	6.0(1)
	FL1W	0.0(0)	2.3(2)	3.2(5)	0.0(0)	8.0(4)	0.0(0)	7.6(7)	0.0(0)	4.3(2)	0.0(0)	5.0(1)	12.0(1)
	FRT	4.0(1)	0.0(0)	3.5(1)	0.0(0)	8.0(1)	0.0(0)	0.0(0)	0.0(0)	3.0(2)	8.8(2)	4.9(6)	0.0(0)
	FL6	0.0(0)	.5(1)	.3(1)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	2.5(1)	0.0(0)
	ART	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.8(1)	0.0(0)
	ERT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	.3(1)	0.0(0)
	FA2	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)
	FU3B	2.0(1)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	3.0(1)	0.0(0)	0.0(0)	6.0(1)	0.0(0)	0.0(0)	0.0(0)
	FU6	0.0(0)	0.0(0)	.5(1)	1.0(1)	0.0(0)	0.0(0)	1.4(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU7	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.1(3)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU8	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.4(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FS3	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	.9(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FBT	0.0(0)	0.0(0)	1.5(1)	0.0(0)	2.0(1)	1.8(1)	1.2(3)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU2W	3.0(1)	6.0(1)	0.0(0)	0.0(0)	0.0(0)	3.0(1)	4.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU5	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FAT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	2.0(2)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FL4	0.0(0)	0.0(0)	1.5(1)	0.0(0)	0.0(0)	1.5(1)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FL5	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FL7	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	1.5(1)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FL8	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FL10	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FS1	0.0(0)	0.0(0)	3.0(2)	0.0(0)	0.0(0)	1.5(1)	.8(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FS2	0.0(0)	0.0(0)	0.0(0)	0.0(0)	4.5(1)	0.0(0)	.8(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU10	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FLT	0.0(0)	4.0(1)	3.0(2)	1.5(1)	6.2(6)	1.6(2)	4.0(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FUT	0.0(0)	2.0(1)	3.5(1)	1.3(1)	4.5(2)	1.8(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FST	0.0(0)	0.0(0)	2.0(2)	1.3(1)	4.0(1)	1.8(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FL3B	0.0(0)	0.0(0)	1.5(1)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU9	3.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
BT3	FL1W	0.0(0)	0.0(0)	0.0(0)	0.0(0)	6.0(2)	2.5(3)	10.0(1)	6.0(1)	5.5(2)	2.9(4)	0.0(0)	8.0(1)
	FU1W	0.0(0)	8.0(1)	0.0(0)	.5(1)	0.0(0)	3.8(2)	12.0(2)	8.7(3)	4.2(3)	1.8(4)	5.0(2)	12.0(1)
	FU2W	0.0(0)	4.3(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.3(2)	4.1(4)	0.0(0)
	LRT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.3(4)	0.0(0)
	FRT	0.0(0)	9.3(1)	2.5(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	5.0(4)	0.0(0)	1.6(5)	0.0(0)
	ART	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.5(4)	0.0(0)
	XRT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.5(4)	0.0(0)
	FU5	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.3(1)	0.0(0)	0.0(0)	5.0(1)	0.0(0)
	FU7	0.0(0)	1.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.3(1)	0.0(0)	0.0(0)	4.0(1)	0.0(0)
	FU10	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	4.1(4)	0.0(0)	0.0(0)
	FU8	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.1(2)	0.0(0)	.4(2)	0.0(0)	0.0(0)
	FS1	0.0(0)	0.0(0)	0.0(0)	3.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	3.8(2)	0.0(0)	0.0(0)
	FU6	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	6.0(1)	.5(2)	0.0(0)	0.0(0)
	FLT	0.0(0)	0.0(0)	3.0(1)	0.0(0)	2.0(1)	1.3(2)	2.0(1)	1.3(2)	0.0(0)	2.0(2)	0.0(0)	0.0(0)
	LU2B	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	6.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FL10	6.0(1)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	6.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FST	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	1.3(2)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU3B	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	6.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FUT	0.0(0)	3.0(1)	0.0(0)	0.0(0)	2.0(1)	1.3(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EU5	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FL6	0.0(0)	0.0(0)	3.0(1)	0.0(0)	0.0(0)	4.3(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FL5	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU9	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.3(0)	0.0(0)
	FA2	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FS3	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)

MEAN ASSIGNMENT TIMES BY SHIP NUMBER (HRS)

PERS. GRADE	ASSIGNED LOCATION	FF-1083	FF-1065	FF-1086	FF-1090	FF-1091	FF-1097	FF-1094	FF-1085	FF-1092	FF-1081	FF-1097	FF-1075
MMC	ERT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	5.0(1)	0.0(0)
	ENT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.5(1)	0.0(0)
	ART	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.5(1)	0.0(0)
	ART	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)
	AU7	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	3.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	X5	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ESIW	0.0(0)	0.0(0)	0.0(0)	0.0(0)	16.0(1)	1.5(1)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AU6	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AUT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ALT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	X2	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
GT	FL7	0.0(0)	0. (0)	0. (0)	0. (0)	0.0(0)	0.0(0)	0.0(0)	6.0(1)	0.0(0)	0.0(0)	0.0(0)	0. (0)
	FU1W	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	6.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
BTFR	FRT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	5.0(1)	0.0(0)	0.0(0)	0.0(0)	4.0(1)	0.0(0)
	FAT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.5(1)	0.0(0)
	FU1W	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	4.0(3)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU2W	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	4.5(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FUT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	3.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FLT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	3.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FST	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU6	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.8(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU7	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.8(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU8	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
BTFA	FRT	4.5(2)	0.0(0)	9.5(2)	0.0(0)	8.2(3)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	12.0(1)
	FA3	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	3.0(1)	0.0(0)
	FU2W	3.8(2)	6.0(1)	0.0(0)	3.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)
	FU1W	0.0(0)	3.0(2)	0.0(0)	1.0(1)	.8(1)	0.0(0)	0.0(0)	6.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FLT	0.0(0)	0.0(0)	0.0(0)	1.3(1)	0.0(0)	1.3(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FL8	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FL1W	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU3B	1.0(1)	0.0(0)	0.0(0)	3.0(1)	0.0(0)	4.3(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FUT	0.0(0)	4.0(1)	0.0(0)	1.3(1)	2.3(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FST	0.0(0)	0.0(0)	0.0(0)	2.8(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FL4	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FL6	0.0(0)	0.0(0)	0.0(0)	1.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU5	0.0(0)	0.0(0)	0.0(0)	2.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FS3	0.0(0)	0.0(0)	0.0(0)	3.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FL7	1.0(1)	0.0(0)	0.0(0)	5.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU8	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)

MEAN ASSIGNMENT TIMES BY SHIP NUMBER (HRS)

PERS. GRADE	ASSIGNED LOCATION	FF-1083	FF-1065	FF-1086	FF-1090	FF-1091	FF-1097	FF-1094	FF-1085	FF-1092	FF-1081	FF-1097	FF-1075
MM2	ART	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	2.5(2)	4.0(1)
	AL1	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)
	AU1B	0.0(0)	4.0(1)	0.0(0)	4.0(2)	0.0(0)	0.0(0)	5.0(1)	0.0(0)	0.0(0)	4.0(1)	0.0(0)	0.0(0)
	AU5	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)
	AU4	1.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)
	AL3	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)
	AL4	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)
	ES2	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	3.0(1)	0.0(0)	0.0(0)
	EU1W	1.0(1)	9.5(2)	0.0(0)	0.0(0)	8.0(1)	0.0(0)	8.0(1)	0.0(0)	0.0(0)	6.0(1)	0.0(0)	0.0(0)
	ES1W	1.0(1)	6.0(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.5(1)	0.0(0)	0.0(0)
	ES4	0.0(0)	0.0(0)	7.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)
	ES3	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)
	FL5	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.5(1)	0.0(0)	0.0(0)
	FL1W	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)
	ERT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	5.0(1)	0.0(0)	0.0(0)	4.0(1)	0.0(0)	8.0(1)	0.0(0)	0.0(0)
	AU2B	0.0(0)	0.0(0)	0.0(0)	3.3(2)	0.0(0)	0.0(0)	0.0(0)	14.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ART	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	6.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AU3	1.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AUT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ALT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	3.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AU6	0.0(0)	0.0(0)	0.0(0)	0.0(0)	12.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AL6	0.0(0)	0.0(0)	0.0(0)	1.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EU8	0.0(0)	0.0(0)	0.0(0)	3.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EU2B	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EU4	0.0(0)	0.0(0)	0.0(0)	4.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EUT	0.0(0)	4.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EL2B	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
MM1	AUT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	8.0(1)	0.0(0)
	AU1B	0.0(0)	2.8(3)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	10.0(1)	0.0(0)	0.0(0)
	ES1W	4.0(1)	0.0(0)	0.0(0)	0.0(0)	3.0(1)	7.0(1)	7.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EL7	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.3(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EUT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ELT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.3(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ES4	0.0(0)	0.0(0)	0.0(0)	0.0(0)	12.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EU3	0.0(0)	6.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EU1W	0.0(0)	16.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AU4	0.0(0)	1.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AU2	4.0(1)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ES2	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ES3	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU3B	1.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AU3	3.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AL6	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)

PERS. GRADE	ASSIGNED LOCATION	MEAN ASSIGNMENT TIMES BY SHIP NUMBER (HRS) FF-1083	FF-1065	FF-1084	FF-1090	FF-1091	FF-1097	FF-1094	FF-1085	FF-1096	FF-1081	FF-1092	FF-1075
MM3	AU4	3.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	.5(1)	12.0(1)
	ERT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	8.0(2)	4.0(2)	3.0(1)	0.0(0)
	AU2B	1.0(1)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	8.7(3)	11.0(1)	0.0(0)	2.5(2)	0.0(0)
	AU1B	0.0(0)	3.0(2)	0.0(0)	4.0(1)	0.0(0)	0.0(0)	4.0(1)	0.0(0)	2.0(1)	5.5(1)	2.2(3)	0.0(0)
	ART	0.0(0)	0.0(0)	3.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	3.0(1)	0.0(0)	3.0(1)	0.0(0)
	EU1W	0.0(0)	6.5(2)	6.5(2)	0.0(0)	0.0(0)	4.0(1)	0.0(0)	6.0(1)	0.0(0)	4.5(4)	3.8(1)	0.0(0)
	ES1W	0.0(0)	6.0(1)	1.8(3)	0.0(0)	0.0(0)	6.0(1)	5.0(4)	4.0(1)	4.7(3)	2.8(3)	3.0(1)	0.0(0)
	EUT	0.0(0)	3.0(1)	1.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	6.0(2)	5.0(1)	0.0(0)
	EL1B	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	4.0(1)	0.0(0)
	AU8	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)
	ALT	0.0(0)	8.0(1)	3.5(1)	8.0(1)	0.0(0)	7.0(1)	2.5(1)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)
	AU7	4.0(1)	4.0(1)	3.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.5(1)	0.0(0)
	AU3	0.0(0)	4.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.5(1)	0.0(0)	0.0(0)
	ES4	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	8.0(1)	0.0(0)	10.0(1)	0.0(0)	0.0(0)	0.0(0)
	AL2	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.8(1)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)
	AL3	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.8(1)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)
	AL4	0.0(0)	0.0(0)	3.0(1)	0.0(0)	0.0(0)	0.0(0)	.8(1)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)
	X4W	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	5.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	X1W	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	X2	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	X3	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	XRT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.8(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AUT	0.0(0)	0.0(0)	0.0(0)	4.0(1)	0.0(0)	2.5(1)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ES3	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.5(1)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EL7	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AU5	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AL6	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	5.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AL5	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.8(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EU8	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	4.5(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EL3	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.8(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EL5	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EU2B	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ST	0.0(0)	0.0(0)	0.0(0)	8.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EST	0.0(0)	0.0(0)	7.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)

MEAN ASSIGNMENT TIMES BY SHIP NUMBER (HRS)

PERS. GRADE	ASSIGNED LOCATION	FF-1083	FF-1065	FF-1084	FF-1090	FF-1091	FF-1097	FF-1094	FF-1085	FF-1092	FF-1081	FF-1097	FF-1075
RMEN	ART	0.0(0)	8.0(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	6.0(1)	8.0(1)	3.1(3)	10.0(1)
	AU4	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	4.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	10.0(1)
	EU1N	0.0(0)	0.0(0)	0.0(0)	0.0(0)	12.0(1)	0.0(0)	0.0(0)	9.0(1)	0.0(0)	5.5(1)	0.0(0)	6.0(1)
	AU1B	0.0(0)	0.0(0)	0.0(0)	4.0(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(2)	0.0(0)
	AU3	0.0(0)	0.0(0)	7.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(2)	0.0(0)
	AU5	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	5.0(1)	0.0(0)	0.0(0)	3.0(1)	0.0(0)
	X3	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.3(1)	0.0(0)
	EUT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.5(1)	0.0(0)
	ES1N	0.0(0)	0.0(0)	15.0(1)	0.0(0)	0.0(0)	0.0(0)	3.0(2)	3.0(1)	2.3(2)	0.0(0)	3.0(1)	0.0(0)
	EST	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	3.0(1)	0.0(0)
	EL7	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	3.0(1)	0.0(0)
	ERT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	3.0(1)	1.0(1)	7.0(3)	0.0(0)	0.0(0)
	FL5	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	9.0(1)	0.0(0)	0.0(0)
	EL1N	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)
	EU4	1.6(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.8(1)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)
	ES3	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)
	AUT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	18.0(1)	0.0(0)	0.0(0)	0.0(0)
	AU2B	0.0(0)	1.0(1)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	8.0(1)	0.0(0)	0.0(0)	0.0(0)
	EU6	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.8(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EU5	1.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.8(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ES4	0.0(0)	0.0(0)	4.0(1)	0.0(0)	0.0(0)	0.0(0)	8.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ALT	0.0(0)	4.0(2)	4.5(1)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EL1M	0.0(0)	0.0(0)	0.0(0)	0.0(0)	8.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ELT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	4.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AL7	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EL3	0.0(0)	0.0(0)	1.0(1)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AL4	0.0(0)	0.0(0)	3.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ES2	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AU8	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EU2B	1.8(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EU6	1.3(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)

MEAN ASSIGNMENT TIMES BY SHIP NUMBER (HRS)

PERS. GRADE	ASSIGNED LOCATION	FF-1083	FF-1065	FF-1084	FF-1090	FF-1091	FF-1097	FF-1094	FF-1085	FF-1092	FF-1081	FF-1047	FF-1075
MMCS	ESIN	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	8.0(1)	0.0(0)	0.0(0)	0.0(0)
	ERT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)
	ART	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)
MM	EUIN	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	6.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AU2B	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	6.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
MMFR	EUT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	6.0(1)	0.0(0)	0.0(0)	0.0(0)
	ART	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	4.0(1)	0.0(0)	0.0(0)	0.0(0)
MMFA	EUIN	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	6.0(1)	0.0(0)	0.0(0)	15.0(1)	0.0(0)	4.5(4)	8.0(1)
	EUT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	4.0(1)	0.0(0)
	ESIN	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	4.0(1)	0.0(0)	0.0(0)	5.0(1)	0.0(0)	0.0(0)	0.0(0)
	AU2B	3.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	8.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AU1B	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	3.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AU6	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	3.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EU8	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ES3	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EL7	0.0(0)	0.0(0)	0.0(0)	4.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AL6	0.0(0)	0.0(0)	3.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AUI	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AU3	0.0(0)	0.0(0)	1.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AU7	0.0(0)	0.0(0)	1.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)

MEAN ASSIGNMENT TIMES BY SHIP NUMBER (HRS)

PERS. GRADE	ASSIGNED LOCATION	FF-1063	FF-1065	FF-1084	FF-1090	FF-1091	FF-1097	FF-1094	FF-1085	FF-1092	FF-1081	FF-1097	FF-1075
EM2	FRT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	4.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FL10	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ESIW	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ERT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ART	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ART	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FL7	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AAW	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EL2B	0.0(0)	0.0(0)	1.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
EM1	ART	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	6.0(1)	0.0(0)	0.0(0)
	ERT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	6.0(1)	0.0(0)	0.0(0)
	EUT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	3.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EST	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	3.0(1)	0.0(0)	0.0(0)	0.0(0)	[illegible]	0.0(0)	0.0(0)
	ELT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	3.0(1)	0.0(0)	0.0(0)	0.0(0)	[illegible]	0.0(0)	0.0(0)
FR	EUIW	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	4.0(1)
	ERT	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
EMC	XRT	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ART	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FRT	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ERT	0.0(0)	0.0(0)	4.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
FA	X4W	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	4.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EUIW	0.0(0)	4.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ESIW	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	X3	0.0(0)	4.0(1)	0.0(0)	0.0(0)	0. (0)	0. (0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	X2	0.0(0)	4.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
FN	AUIB	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.5(2)	0.0(0)
	AU6	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.5(2)	0.0(0)
	AU7	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(2)	0.0(0)
	AU2B	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(2)	0.0(0)
	ERT	0.0(0)	0.0(0)	.8(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(2)	0.0(0)
	FRT	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.5(1)	0.0(0)	0.0(0)	3.0(1)	0.0(0)
	FUIW	0.0(0)	4.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EU4	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.8(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EU5	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.8(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EU6	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.8(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EUW	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.8(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ELT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FU3B	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FLIW	0.0(0)	0.0(0)	1.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FB2	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	XRT	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FMT	0.0(0)	4.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)

MEAN ASSIGNMENT TIMES BY SHIP NUMBER (HRS)

PERS. GRADE	ASSIGNED LOCATION	FF-1083	FF-1065	FF-1066	FF-1090	FF-1091	FF-1097	FF-1094	FF-1085	FF-1092	FF-1081	FF-1097	FF-1075
EN3	X2	0.0(0)	3.0(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	4.0(1)	0.0(0)	0.0(0)
	X5	0.0(0)	1.0(1)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EU2B	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	XRT	0.0(0)	0.0(0)	1.5(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	X4W	0.0(0)	4.0(3)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	X3	0.0(0)	0.0(0)	3.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
EN2	X3	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.3(1)	0.0(0)
EN1	X4W	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	5.0(1)	0.0(0)	0.0(0)	0.0(0)	3.0(1)	0.0(0)
	X1	0.0(0)	2.0(1)	4.8(1)	0.0(0)	0.0(0)	0.0(0)	1.5(1)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)
	XRT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	5.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	X1W	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.8(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	X2	0.0(0)	2.0(1)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	.8(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	X5	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
ENFA	AL4	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AUT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
ENFN	X4W	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	4.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ALT	0.0(0)	0.0(0)	0.0(0)	4.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AUT	0.0(0)	0.0(0)	0.0(0)	4.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
EN3	XRT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.3(1)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ERT	0.0(0)	0.0(0)	.3(1)	0.0(0)	0.0(0)	0.0(0)	.3(1)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ENT	0.0(0)	0.0(0)	.3(1)	0.0(0)	0.0(0)	0.0(0)	.5(1)	4.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ART	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	X4W	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.3(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EUT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EST	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.3(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ELT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.3(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AU2B	0.0(0)	0.0(0)	0.0(0)	4.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
		0.0(0)	0.0(0)	.3(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AUW	0.0(0)	0.0(0)	.3(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ALT	0.0(0)	0.0(0)	.3(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	EL7	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ESIM	0.0(0)	0.0(0)	.3(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)

MEAN ASSIGNMENT TIMES BY SHIP NUMBER (HRS)

PERS. GRADE	ASSIGNED LOCATION	FF-1083	FF-1085	FF-1088	FF-1090	FF-1091	FF-1097	FF-1094	FF-1095	FF-1092	FF-1081	FF-1097	FF-1075
LCDR	FB2	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)
ENS	ERT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.8(1)	1.3(1)	0.0(0)
	FRT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.9(2)	1.0(1)	0.0(0)
	ART	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.8(1)	1.0(1)	0.0(0)
	ART	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	.6(1)	1.0(1)	0.0(0)
	ESIW	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	1.3(2)	0.0(0)	0.0(0)
	FUIW	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	6.0(1)	0.0(0)	0.0(0)
	FLIO	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AU2	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ES4	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.3(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	A2	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.3(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
LTJG	ESIW	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	.5(1)	0.0(0)	0.0(0)
	EUIW	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.3(1)	0.0(0)	0.0(0)
	ES1	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.3(1)	0.0(0)	0.0(0)
	FUIW	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.3(1)	0.0(0)	0.0(0)
	EU2W	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.3(1)	0.0(0)	0.0(0)
	ERT	0.0(0)	0.0(0)	1.3(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.3(1)	.5(1)	1.0(1)	0.0(0)	0.0(0)
	FRT	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	1.0(1)	0.0(0)	0.0(0)
	ART	0.0(0)	0.0(0)	.8(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.0(1)	1.0(1)	0.0(0)	0.0(0)
	ART	0.0(0)	0.0(0)	.5(2)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)
	FLT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FUT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FST	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ST	0.0(0)	0.0(0)	.3(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ERT	0.0(0)	0.0(0)	.3(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FLIW	1.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
LT	ART	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.3(1)	0.0(0)
	FUIW	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	4.0(1)	0.0(0)	0.0(0)
	FLIO	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	2.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ESIW	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ES3	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.3(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	AL6	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.3(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FLT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FUT	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FST	0.0(0)	0.0(0)	0.0(0)	0.0(0)	.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ERT	0.0(0)	0.0(0)	1.5(1)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	FRT	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
	ART	0.0(0)	0.0(0)	0.0(0)	2.0(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)
ENFN	A2	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	4.0(1)	0.0(0)	0.0(0)
	ART	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	7.0(1)	0.0(0)	0.0(0)
	ASW	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	4.5(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)

APPENDIX E

Individual Noise Exposure Results
For Each Ship Using Noise Levels
Measured at Individual Locations

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 60.0 DBA
8-HR PERMISSIBLE LEVEL = 90 DBA
~~EXCHANGE RATE~~ = 5 DBA

FF-1083 USS COOK

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.L.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.L.
60200	LTJG	1	71.0	71.0	.07	.07
20700	MMFA	1	78.9	78.9	.22	.22
~~20601~~	~~MMFN~~	1	69.0	69.0	.05	.05
20600	MMFN	1	80.0	80.0	.25	.25
20501	MM3	1	79.9	79.9	.25	.25
~~20500~~	~~MM3~~	1	86.7	86.7	.63	.63
20401	MM2	1	82.2	82.2	.34	.34
20400	MM2	1	70.0	70.0	.06	.06
~~20301~~	~~MM1~~	1	91.4	91.4	1.21	1.21
20300	MM1	1	79.6	79.6	.24	.24
10702	ETFA	1	89.4	90.2	.92	1.02
~~10701~~	~~ETFA~~	1	85.2	85.2	.52	.52
10700	ETFA	1	84.0	84.0	.44	.44
10602	ETFN	1	79.9	79.9	.25	.25
~~10601~~	~~ETFN~~	1	85.4	85.4	.53	.53
10600	ETFN	1	85.9	85.9	.57	.57
10500	ET3	1	82.9	82.9	.38	.38
~~10403~~	~~ET2~~	1	****	****	.00	0.00
10402	ET2	1	91.1	91.1	1.16	1.16
10401	ET2	1	84.1	84.1	.44	.44
~~10400~~	~~ET2~~	1	68.9	68.9	.05	.05

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1065 USS STEIN

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.O.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.O.C.
50502	EN3	1	[illegible]	[illegible]	.00	0.00
50501	EN3	1	[illegible]	[illegible]	.00	0.00
50500	EN3	1	[illegible]	[illegible]	.00	0.00
50300	EN1	1	[illegible]	[illegible]	.00	0.00
30201	FA	1	[illegible]	[illegible]	.00	0.00
30200	FA	1	82.0	82.0	.33	.33
30100	FN	1	82.3	84.9	.35	.49
20602	MMFN	1	94.5	95.4	1.57	2.10
20601	MMFN	1	90.4	93.5	1.13	1.62
20600	MMFN	1	89.7	94.2	.96	[illegible]
20504	MM3	1	88.1	88.1	.58	.58
20503	MM3	1	92.8	94.8	1.46	1.94
20502	MM3	1	90.5	90.8	1.08	[illegible]
20501	MM3	1	77.0	77.0	.16	.16
20500	MM3	2	75.9	81.7	.22	.32
20402	MM2	1	80.8	80.8	.05	.05
20401	MM2	1	91.5	91.5	1.24	1.24
20400	MM2	1	[illegible]	[illegible]	.00	0.00
20302	MM1	1	79.1	79.1	.22	.22
20301	MM1	1	93.4	93.4	1.61	1.61
20300	MM1	1	87.6	87.6	.68	.68
20200	MMC	1	[illegible]	[illegible]	.00	0.00
10701	BTFA	1	82.3	84.9	.35	.49
10700	BTFA	1	85.4	85.4	.57	.57
10602	BTFN	1	85.2	85.4	.51	.56
10601	BTFN	1	75.5	75.8	.14	.14
10600	BTFN	1	91.8	91.8	1.29	1.29
10502	BT3	1	85.6	85.6	.54	.54
10501	BT3	1	74.0	74.0	.11	.11
10500	BT3	1	92.0	92.0	1.40	1.40
10400	BT2	1	85.0	86.0	.50	.57
10300	BT1	1	80.3	82.8	.26	.37
10200	BTC	1	84.8	84.8	.49	.49

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1084 USS CANDLESS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL R.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE R.C.
60202	LTJG	1	72.1	75.4	.08	.13
60201	LTJG	1	80.3	85.0	.26	.41
60200	LTJG	1	84.1	88.2	.44	.59
60100	LT	1	72.1	75.4	.08	.13
50501	EN3	1	96.4	96.4	2.44	2.44
50500	EN3	1	95.4	97.0	2.11	2.06
50300	EN1	1	100.5	100.5	4.28	4.25
40500	EM3	1	70.4	71.3	.07	.07
40400	EM2	1	74.9	74.9	.12	.12
40200	EMC	1	89.3	91.3	.90	1.20
30300	FR	1	74.2	77.5	.11	.15
30102	FN	1	67.1	70.4	.04	.07
30101	FN	1	85.3	86.6	.52	.52
30100	FN	1	78.9	[illegible]	.21	.27
20700	MMFA	1	87.1	87.1	.67	.67
20603	MMFN	1	87.5	87.5	.71	.71
20602	MMFN	1	80.3	80.3	.26	.26
20601	MMFA	1	59.9	59.8	.00	0.00
20600	MMFN	1	87.5	88.9	.71	.86
20504	MM3	1	88.1	88.1	.77	.77
20503	MM3	1	81.0	81.0	.29	.29
20502	MM3	1	84.7	86.2	.45	.59
20501	MM3	1	72.0	72.0	.06	.06
20500	MM3	1	86.4	87.7	.60	.73
20401	MM2	1	81.0	81.0	.29	.29
20400	MM2	1	[illegible]	[illegible]	.00	0.00
10701	ETFA	1	83.5	88.4	.41	.61
10700	ETFA	1	87.4	[illegible]	.70	.81
10606	ETFN	1	82.8	84.5	.37	.47
10605	ETFN	1	60.6	60.6	.03	.03
10604	ETFN	1	79.0	79.0	.22	.22
10603	ETFN	1	80.8	80.8	.28	.25
10602	ETFN	1	77.4	77.4	.17	.17
10601	ETFN	1	84.2	85.0	.45	.50
10600	ETFN	1	84.3	84.3	.45	.45
10501	ET3	1	77.0	78.2	.17	.19

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1084 USS CANDLESS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL W.C.	DAILY NOISE DOS MEAN	DAILY NOISE DOS W.C.
10500	ET3	1	83.0	85.0	.38	.50
10400	ET2	1	81.1	82.0	.29	.33
10300	ET1	1	79.5	77.4	.12	.17
10201	ETC	1	76.8	76.8	.16	.16
10200	ETC	1	[redacted]	[redacted]	.00	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1097 USS MOINESTER

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.C.
40500	EM3	1	76.9	7[illegible].3	.15	.20
40400	EM2	1	81.0	81.0	.29	.29
40300	EM1	1	83.2	84.8	.39	.47
20702	MMFA	1	71.0	71.0	.07	.07
20701	MMFA	1	85.9	85.9	.57	.57
20700	MMFA	1	84.9	84.9	.49	.49
20504	MM3	1	71.0	71.0	.07	.07
20503	MM3	1	83.0	83.0	.38	.38
20502	MM3	1	91.0	92.9	1.15	1.49
20501	MM3	1	85.2	85.7	.51	.55
20500	MM3	1	81.4	81.4	.31	.31
20400	MM2	1	88.1	89.5	.77	.91
20300	MM1	1	[illegible]	[illegible]	.00	0.00
20200	MMC	1	84.3	85.3	.45	.52
14700	ETFA	1	88.1	88.1	.77	.77
10603	ETFN	1	90.7	92.8	1.10	1.47
10602	ETFN	1	95.5	95.5	2.14	2.14
10601	ETFN	1	95.7	95.6	1.08	2.12
10600	ETFN	1	81.0	81.0	.29	.29
10503	ET3	1	92.0	92.0	1.32	1.32
10502	ET3	1	90.3	90.5	1.05	1.05
10501	ET3	1	90.7	92.8	1.11	1.47
10500	ET3	1	88.3	90.3	.80	1.04
10401	ET2	1	[illegible]	[illegible]	.00	0.00
10400	ET2	1	86.0	86.0	.57	.57
10300	ET1	1	95.0	100.3	2.23	4.15
10200	ETC	1	90.2	90.9	2.36	3.23

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1090 USS AINSWORTH

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL R.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE R.C.
60100	LT	1	93.8	96.6	1.65	2.49
40601	EMFN	1	81.6	83.5	.31	.41
40600	EMFN	1	85.6	88.8	.55	.65
40500	EM3	1	80.0	80.0	.25	.25
20700	MMFA	1	****	****	.00	.00
20602	MMFN	1	74.0	74.0	.11	.11
20601	MMFN	1	82.0	82.0	.33	.33
20600	MMFN	1	86.8	86.8	.64	.64
20502	MM3	1	93.9	97.8	1.52	2.93
20501	MM3	1	86.8	86.8	.64	.64
20500	MM3	1	90.0	92.0	1.09	1.29
20402	MM2	1	85.1	85.1	.56	.56
20401	MM2	1	76.0	76.0	.19	.19
20400	MM2	1	87.4	87.4	.70	.70
10703	GTFA	1	80.3	80.3	.26	.26
10702	GTFA	1	82.4	83.5	.35	.41
10701	GTFA	1	82.1	83.4	.33	.40
10700	GTFA	1	74.9	74.9	.12	.12
10600	GTFN	1	82.7	84.0	.36	.43
10500	GT3	1	81.6	81.6	.31	.31
10400	GT2	1	82.1	82.1	.33	.33
10200	GTC	1	79.7	83.3	.24	.40

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1091 USS MILLER

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL MAX.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE MAX.
60200	LTJG	1	76.0	77.4	.14	.17
60100	LT	1	74.4	76.1	.11	.15
40300	CW1	1	****	****	.00	0.00
20601	EMFN	1	82.9	85.4	.37	.53
20600	EMFN	1	91.9	91.9	1.31	1.31
20401	EM2	1	91.5	91.5	1.23	1.23
20400	EM2	1	91.9	91.9	1.31	1.31
20300	EM1	1	80.9	80.9	.65	.55
20200	EMC	1	****	****	.00	0.00
10701	ETFA	1	83.4	90.8	.60	1.12
10700	ETFA	2	85.2	90.3	.52	1.05
10606	ETFN	1	91.2	92.0	1.19	1.43
10605	ETFN	1	87.1	87.1	.67	.67
10604	ETFN	1	85.3	85.1	.40	.51
10603	ETFN	1	86.9	85.9	.65	.55
10602	ETFN	2	87.5	87.8	.73	.73
10601	ETFN	1	85.9	86.0	.65	.76
10600	ETFN	1	83.5	85.1	.41	.51
10501	ET3	1	87.2	86.4	.66	.56
10500	ET3	1	84.0	84.6	.44	.44
10400	ET2	3	81.1	83.6	.29	.41
10301	ET1	1	78.1	81.0	.19	.31
10300	ET1	1	74.9	74.9	.12	.12
10200	ETC	1	75.1	71.6	.05	.08

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1094 USS PHARRIS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL R.E.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE R.E.
50300	EN1	1	[redacted]	[redacted]	.00	0.00
40700	EMFA	1	73.5	74.1	.10	.11
40501	EM3	1	[redacted]	[redacted]	.00	0.00
40500	EM3	1	74.7	75.6	.12	.14
40400	EM2	1	77.6	78.4	.18	.20
30100	FN	1	82.4	82.4	.35	.35
20602	MMFN	1	89.0	89.3	.86	.91
20601	MMFN	1	83.0	83.0	.38	.38
20600	MMFN	1	78.2	78.2	.20	.20
20506	MM3	1	87.3	87.3	.69	.69
20505	MM3	2	[redacted]	[redacted]	.00	0.00
20504	MM3	1	89.1	89.1	.69	.69
20503	MM3	1	84.3	84.3	.45	.45
20502	MM3	1	87.3	87.4	.69	.70
20501	MM3	1	[redacted]	[redacted]	.00	0.00
20500	MM3	1	[redacted]	[redacted]	.00	0.00
20401	MM2	1	90.0	90.0	1.00	1.00
20400	MM2	1	89.1	89.1	.69	.69
20300	MM1	1	74.1	74.1	.11	.11
10802	GTFN	1	91.0	91.0	1.15	1.15
10801	GTFN	1	87.5	88.6	.71	.82
10800	GTFN	1	89.4	89.4	.92	.92
10605	GTFN	2	88.7	91.7	.83	1.27
10604	GTFN	2	87.4	87.5	.75	.75
10603	GTFN	1	86.3	86.3	.60	.60
10602	GTFN	1	88.9	88.9	.86	.86
10601	GTFN	1	91.4	91.4	1.21	1.21
10600	GTFN	1	86.7	86.7	.64	.64
10502	GT3	1	85.9	85.9	.57	.57
10501	GT3	1	88.3	88.8	.79	.85
10500	GT3	2	[redacted]	[redacted]	.00	0.00
10401	GT2	1	85.1	85.1	.51	.51
10400	GT2	1	81.7	81.7	.31	.31
10301	GT1	1	75.6	76.9	.14	.16
[illegible]	GT1	1	68.4	71.1	.05	.07

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1085 USS BEARY

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.C.
60301	ENS	1	91.9	95.1	1.31	2.03
60300	ENS	1	87.5	87.5	.70	.70
60200	LTJG	1	74.6	77.6	.12	.15
60100	LT	1	83.2	83.2	.39	.39
50600	ENFN	1	[illegible]	[illegible]	.00	0.00
50500	EN3	1	94.3	96.7	1.61	2.53
50300	EN1	1	98.5	100.0	3.27	4.35
40600	EMFN	1	[illegible]	[illegible]	.00	0.00
40500	EM3	1	85.5	90.0	.62	1.00
40400	EM2	1	89.0	92.2	.87	1.36
30200	FA	1	[illegible]	[illegible]	.00	0.00
30100	FN	1	84.5	88.1	.47	.77
20901	MR	1	83.9	83.9	.43	.43
20900	MR	1	89.9	89.9	.99	.99
20700	MMFA	1	86.0	86.0	.57	.57
20602	MMFN	1	[illegible]	[illegible]	.00	0.00
20601	MMFN	1	94.2	94.2	1.79	1.79
20600	MMFN	1	87.6	87.6	.72	.72
20503	MM3	1	83.9	83.9	.43	.43
20502	MM3	1	89.9	89.9	.99	.99
20501	MM3	1	86.0	86.0	.57	.57
20500	MM3	1	88.9	88.9	.86	.86
20402	MM2	1	99.9	102.1	3.92	5.36
20401	MM2	1	85.5	88.3	.40	.80
20400	MM2	1	90.0	90.0	1.01	1.01
20200	MMC	1	88.2	88.2	.76	.76
10901	GT	1	[illegible]	[illegible]	.00	0.00
10900	GT	1	88.9	88.9	.86	.86
10700	GTFA	1	[illegible]	[illegible]	.00	0.00
10600	GTFA	1	[illegible]	[illegible]	.00	0.00
10505	GT3	1	74.7	80.3	.24	.26
10504	GT3	1	90.6	90.6	1.06	1.06
10503	GT3	1	82.9	86.5	.37	.62
10502	GT3	1	82.9	82.9	.38	.38
10501	GT3	1	88.9	88.9	.86	.86
10500	GT3	1	84.3	84.3	.45	.45

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1085 USS BEARY

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL R.M.S.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE R.M.S.
10301	ET1	1	86.1	89.6	.56	.95
10300	ET1	1	87.9	87.9	.75	.75

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1092 USS HART

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.L.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.L.
60200	LTJG	1	77.5	75.6	.18	.21
21000	MMCS	1	72.0	74.3	.06	.11
20800	MMFF	1	87.3	85.5	.69	.74
20700	MMFA	1	93.5	95.5	1.03	1.03
20602	MMFN	1	83.0	85.2	.38	.51
20601	MMFN	1	75.5	76.9	.10	.16
20600	MMFN	1	89.6	92.1	.97	1.34
20504	MM3	1	82.2	82.2	.34	.34
20503	MM3	1	78.0	88.2	.19	.28
20502	MM3	1	85.6	85.6	.54	.54
20501	MM3	1	92.5	97.9	1.42	2.22
20500	MM3	1	[redacted]	[redacted]	.00	0.00
10605	ETFN	1	73.9	76.5	.22	.22
10604	ETFN	1	85.9	85.9	.57	.57
10603	ETFN	1	76.6	72.7	.07	.07
10602	ETFN	1	[redacted]	[redacted]	.00	[illegible]
10601	ETFN	1	80.0	80.0	.58	.55
10600	ETFN	1	88.5	71.9	.05	.06
10505	ET3	1	75.5	75.7	.14	.14
10504	ET3	1	87.6	87.6	.72	.72
10503	ET3	1	[redacted]	[redacted]	.00	0.00
10502	ET3	1	87.9	80.0	.75	.82
10501	ET3	1	87.0	87.0	.66	.66
10500	ET3	1	84.9	85.0	.50	.55
10400	ET2	2	[redacted]	[redacted]	.00	0.00
10300	ET1	1	85.9	85.9	.57	.57
10100	ETCM	1	78.0	78.0	.14	.14

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1081 USS AYLWIN

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL W.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE W.C.
60301	ENS	1	75.9	77.5	.14	.16
60300	ENS	1	81.1	82.5	.29	.34
60200	LTJG	1	85.1	85.1	.51	.51
60100	LT	1	[redacted]	[redacted]	.00	0.00
50600	ENFN	1	83.4	88.8	.40	.63
50500	EN3	1	[redacted]	[redacted]	.00	0.00
40300	EM1	1	86.9	91.0	.65	1.15
20604	MMFN	1	88.0	88.0	.76	.76
20603	MMFN	1	89.2	89.2	.89	.89
20602	MMFN	1	82.3	85.5	.34	.54
20601	MMFN	2	87.7	90.0	.73	.99
20600	MMFN	1	80.7	89.2	.83	.90
20503	MM3	1	85.3	85.3	.52	.52
20502	MM3	2	82.3	85.5	.34	.54
20501	MM3	2	85.0	85.0	.54	.54
20500	MM3	2	80.5	88.5	.62	.72
20404	MM2	1	87.3	89.1	.66	.85
20403	MM2	1	81.0	83.7	.29	.32
20402	MM2	1	87.0	87.8	.72	.72
20401	MM2	1	[redacted]	[redacted]	.00	0.00
20400	MM2	1	85.0	85.0	.50	.50
20300	MM1	1	87.0	87.8	.72	.72
10601	ETFN	1	92.4	92.4	1.39	1.39
10600	ETFN	1	92.5	93.4	1.41	2.11
10502	ET3	2	85.0	86.5	.54	.62
10501	ET3	2	89.4	89.4	.91	.91
10500	ET3	2	88.0	88.0	.57	.57
10400	ET2	1	94.7	96.7	1.91	2.55
10300	ET1	1	89.9	92.0	.99	1.40

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DB

FF-1097 USS MOINESTER

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL R.M.S.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE R.M.S.
60400	LCDR	1	****	****	.00	0.00
60300	ENS	1	82.7	84.7	.37	.45
60100	LT	1	83.6	87.8	.33	.93
50400	EN2	1	****	****	.00	0.00
50300	EN1	1	74.9	74.9	.12	.12
30101	FN	1	84.0	85.7	.44	.53
30100	FN	2	84.8	84.8	.49	.49
20701	MMFA	1	78.8	78.8	.21	.21
20700	MMFA	3	87.6	87.6	.72	.72
20606	MMFN	1	81.9	81.9	.33	.33
20605	MMFN	1	75.0	76.9	.13	.16
20604	MMFN	1	76.4	79.4	.15	.20
20603	MMFN	1	****	****	.00	0.00
20602	MMFN	1	85.5	87.7	.56	.73
20601	MMFN	1	83.9	86.9	.45	.60
20600	MMFN	2	82.4	85.8	.35	.41
20506	MM3	1	85.0	85.5	.57	.60
20505	MM3	1	79.9	79.0	.22	.22
20504	MM3	1	81.4	83.4	.39	.40
20503	MM3	1	81.0	82.0	.29	.29
20502	MM3	1	82.5	82.5	.36	.36
20501	MM3	1	85.3	86.5	.52	.62
20500	MM3	1	77.9	80.0	.19	.25
20401	MM2	1	83.4	84.5	.46	.47
20400	MM2	1	81.7	83.7	.32	.42
20300	MM1	1	85.3	87.1	.65	.67
20200	MMC	1	90.1	91.5	1.01	1.24
10801	ETFR	1	75.7	76.8	.14	.16
10800	ETFR	1	80.1	90.2	.56	1.33
10701	ETFA	1	73.0	73.0	.09	.09
10700	ETFA	1	75.9	75.9	.14	.14
10602	ETFN	1	75.4	76.8	.13	.16
10601	ETFN	1	80.2	80.2	.54	.54
10600	ETFN	5	85.6	92.9	.85	1.50
10503	ET3	1	93.4	93.4	1.01	1.01
10502	ET3	1	81.1	85.2	.29	.52

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1097 USS MOINESTER

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.D.
10501	GT3	4	92.2	92.4	1.35	1.40
10500	GT3	2	****	****	.00	0.00
10400	GT2	4	81.1	85.3	.29	.74
10200	GTC	1	****	****	.00	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1075 USS TRIPPE

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.E.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.E.
30300	FR	1	79.0	79.0	.22	.22
20700	MMFA	1	84.0	84.0	.44	.44
20602	MMFN	1	84.0	84.0	.44	.44
20601	MMFN	1	89.6	89.0	.95	.95
20600	MMFN	1	89.9	91.7	.96	1.26
20500	MM3	1	90.9	90.9	1.14	1.14
20400	MM2	1	83.3	85.1	.39	.51
10700	ETFA	1	90.5	93.0	1.07	1.51
10601	ETFN	1	90.9	90.9	1.14	1.14
10600	ETFN	1	****	****	.00	0.00
10501	ET3	1	****	****	.00	0.00
10500	ET3	1	86.0	86.0	.76	.76
10401	ET2	1	87.5	90.0	.71	1.02
10400	ET2	2	****	****	.00	0.00
10300	ET1	1	****	****	.00	0.00

APPENDIX F

**Grade Average Noise Exposure Results
For Each Ship Using Noise Levels
Measured at Individual Locations**

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 60.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1083 USS COOK

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
203	MM1	2	85.5	6.3	.72	.69
107	ETFA	3	86.4	2.6	.64	.25
104	ET2	4	87.4	3.5	.56	.46
205	MM3	2	84.3	6.2	.54	.41
106	ETFN	3	83.8	3.3	.45	.15
105	ET3	1	82.9	0.0	.38	0.00
207	MMFA	1	78.9	0.0	.22	0.00
204	MM2	2	76.1	6.6	.20	.19
206	MMFN	2	74.5	7.8	.15	.14
602	LTJG	1	71.0	0.0	.07	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1065 USS STEIN

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
206	MMFN	3	91.7	2.5	1.32	.49
203	MM1	3	88.5	7.2	.83	.71
105	ET3	3	84.1	9.5	.71	.70
204	MM2	3	90.2	1.9	.69	.63
106	ETFN	3	84.3	8.1	.65	.59
205	MM3	6	84.1	6.7	.62	.55
104	ET2	1	85.0	0.0	.50	0.00
102	ETC	1	84.8	0.0	.49	0.00
107	ETFA	2	84.1	2.5	.46	.16
301	FN	1	82.3	0.0	.35	0.00
103	ET1	1	80.3	0.0	.26	0.00
302	FA	2	82.0	0.0	.18	.25
202	MMC	1	####	####	.00	0.00
503	EN1	1	####	####	.00	0.00
505	EN3	3	####	####	.00	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1084 USS CANDLESS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
503	EN1	1	100.5	0.0	4.28	0.00
505	EN3	2	95.9	.7	2.28	.23
402	EMC	1	89.3	0.0	.95	0.00
207	MMFA	1	87.1	0.0	.87	0.00
107	GTFA	2	85.4	2.7	.55	.20
205	MM3	5	82.4	6.4	.44	.27
206	MMFN	4	85.1	4.2	.42	.35
106	GTFN	7	82.4	3.8	.39	.22
104	GT2	1	81.1	0.0	.29	0.00
105	GT3	2	80.0	4.2	.27	.15
602	LTJG	3	78.8	6.1	.26	.16
301	FN	3	77.1	9.2	.26	.24
204	MM2	2	81.0	0.0	.14	.23
404	EM2	1	74.9	0.0	.12	0.00
103	GT1	1	74.5	0.0	.12	0.00
303	FR	1	74.2	0.0	.11	0.00
601	LT	1	72.1	0.0	.08	0.00
102	GTC	2	76.6	0.0	.08	.11
405	EM3	1	70.4	0.0	.07	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1090 USS AINSWORTH

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
601	LT	1	93.6	0.0	1.65	0.00
205	MM3	3	90.2	3.1	1.08	.44
204	MM2	3	83.8	5.1	.44	.27
406	EMFN	2	83.6	2.8	.43	.16
106	ETFN	1	82.7	0.0	.38	0.00
206	MMFN	3	80.9	6.5	.36	.27
104	ET2	1	82.1	0.0	.33	0.00
105	ET3	1	81.6	0.0	.31	0.00
107	ETFA	4	79.9	3.5	.27	.20
405	EM3	1	80.0	0.0	.25	0.00
102	FTC	1	79.7	0.0	.24	0.00
207	MMFA	1	****	.****	.00	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1091 USS MILLER

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
204	MM2	2	91.7	.3	1.27	.05
206	MMFN	2	87.4	6.4	.64	.06
106	BTFN	6	86.8	2.5	.66	.24
203	MM1	1	86.9	0.0	.65	0.00
107	BTFA	3	86.3	1.8	.61	.16
105	BT3	2	85.6	2.2	.56	.17
104	BT2	3	81.1	0.0	.29	0.00
103	BT1	2	76.5	2.2	.16	.05
602	LTJG	1	76.0	0.0	.14	0.00
601	LT	1	74.4	0.0	.11	0.00
102	BTC	1	68.1	0.0	.05	0.00
202	MMC	1	****	****	.00	0.00
403	EM1	1	****	****	.00	0.00

AD-A115 272 BOLT BERANEK AND NEWMAN INC CANOGA PARK CA F/G 6/19

DEVELOPMENT AND VALIDATION OF SHIPBOARD NOISE EXPOSURE DATA ACQ--ETC(U)

NOV 81 B A KUGLER, C H HANSEN, A G PIERSOL N00014-78-C-0408

UNCLASSIFIED BBN-4735 NL

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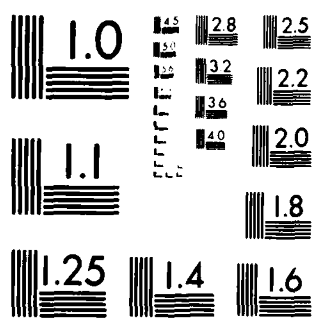

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1097 USS MOINESTER

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
102	GTC	1	96.2	0.0	2.36	0.00
103	GT1	1	95.6	0.0	2.23	0.00
106	GTFR	4	90.2	6.5	1.30	.50
105	GT3	4	90.3	1.5	1.06	.21
107	GTFA	1	86.1	0.0	.77	0.00
204	MM2	1	88.1	0.0	.77	0.00
205	MM3	5	82.3	7.3	.46	.41
202	MMC	1	84.3	0.0	.45	0.00
403	EM1	1	83.2	0.0	.39	0.00
207	MMFA	3	80.6	6.3	.38	.27
104	GT2	2	86.0	0.0	.29	.41
404	EM2	1	81.0	0.0	.29	0.00
405	EM3	1	76.9	0.0	.10	0.00
203	MM1	1	****	****	.00	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
~~EXCHANGE RATE = 5 DBA~~

FF-1094 USS PHARRIS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
204	MM2	2	89.6	.6	.94	.08
108	BTFR	3	89.3	1.8	.93	.22
~~106~~	~~BTFN~~	~~6~~	88.6	1.4	.63	.17
206	MMFN	3	83.4	5.4	.46	.35
104	BT2	2	85.4	2.4	.41	.13
~~301~~	~~FN~~	~~1~~	82.4	0.0	.35	0.00
205	MM3	8	87.0	2.0	.34	.38
105	BT3	4	87.1	1.7	.34	.40
~~404~~	~~EM2~~	~~1~~	77.8	0.0	.18	0.00
203	MM1	1	74.1	0.0	.11	0.00
407	EMFA	1	73.5	0.0	.10	0.00
103	BT1	2	72.0	5.1	.09	.06
405	EM3	2	74.7	0.0	.08	.08
503	EN1	1	****	****	.00	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1085 USS BEARY

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
503	EN1	1	98.5	0.0	3.27	0.00
505	EN3	1	94.3	0.0	1.81	0.00
204	MM2	3	91.1	6.2	1.76	1.36
603	ENS	2	89.7	3.2	1.01	.43
404	EM2	1	89.0	0.0	.87	0.00
206	MMFN	3	90.9	4.7	.84	.98
405	EM3	1	88.6	0.0	.82	0.00
202	MMC	1	88.2	0.0	.78	0.00
205	MM3	4	87.2	2.7	.71	.26
209	MM	2	86.9	4.2	.71	.40
103	BT1	2	87.0	1.3	.67	.12
207	MMFA	1	86.0	0.0	.57	0.00
105	BT3	6	84.9	4.1	.56	.33
301	FN	1	84.5	0.0	.47	0.00
104	BT	2	88.9	0.0	.43	.61
601	LT	1	83.2	0.0	.39	0.00
602	LTJG	1	74.6	0.0	.12	0.00
106	BTFA	1	[illegible]	[illegible]	.00	0.00
107	BTFA	1	[illegible]	[illegible]	.00	0.00
302	FA	1	[illegible]	[illegible]	.00	0.00
406	EMFN	1	[illegible]	[illegible]	.00	0.00
506	ENFN	1	[illegible]	[illegible]	.00	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1092 USS HART

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
207	MMFA	1	93.5	0.0	1.23	0.00
208	MMFK	1	87.3	0.0	.69	0.00
103	BT1	1	85.9	0.0	.57	0.00
205	MM3	5	84.6	6.1	.50	.55
206	MMFN	3	82.1	6.2	.48	.44
105	BT3	6	84.2	6.1	.45	.33
106	BTFN	6	76.0	6.3	.25	.20
101	BTCM	1	78.0	0.0	.19	0.00
602	LTJG	1	77.5	0.0	.16	0.00
210	MMCS	1	72.0	0.0	.08	0.00
104	BT2	2	[illegible]	[illegible]	.00	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1081 USS AYLWIN

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
104	ET2	1	94.7	0.0	1.91	0.00
106	ETFN	2	92.4	.1	1.40	.02
103	ET1	1	89.9	0.0	.99	0.00
403	EM1	1	88.9	0.0	.85	0.00
203	MM1	1	87.6	0.0	.72	0.00
206	MMFN	6	87.3	2.5	.71	.14
105	ET3	6	87.0	1.9	.66	.19
205	MM3	7	85.4	2.6	.56	.19
602	LTJG	1	85.1	0.0	.51	0.00
204	MM2	5	85.2	3.0	.44	.30
506	ENFN	1	83.4	0.0	.40	0.00
603	ENS	2	78.5	3.7	.22	.11
505	EN3	1	[illegible]	[illegible]	.00	0.00
601	LT	1	[illegible]	[illegible]	.00	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1097 USS MOINESTER

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
202	MMC	1	90.1	0.0	1.01	0.00
105	ET3	8	90.5	4.6	.91	.69
106	ETFN	7	88.5	5.0	.71	.27
203	MM1	1	88.3	0.0	.60	0.00
207	MMFA	4	85.4	4.4	.59	.25
301	FN	3	84.5	.4	.47	.03
603	ENS	1	82.7	0.0	.37	0.00
108	ETFR	2	80.9	7.4	.36	.32
204	MM2	2	82.6	1.2	.36	.06
205	MM3	7	81.9	3.0	.35	.15
104	ET2	4	81.1	0.0	.29	0.00
206	MMFN	6	80.7	3.7	.27	.17
503	EN1	1	74.9	0.0	.12	0.00
107	ETFA	2	74.5	2.1	.12	.03
601	LT	1	63.8	0.0	.03	0.00
102	ETC	1	****	****	.00	0.00
504	EN2	1	****	****	.00	0.00
664	LCDR	1	****	****	.00	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
~~EXCHANGE RATE~~ = 5 DBA

FF-1075 USS TRIPPE

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
205	MM3	1	90.9	0.0	1.14	0.00
107	ETFA	1	90.5	0.0	1.07	0.00
~~206~~	~~MMFN~~	~~3~~	87.8	5.3	.79	.31
106	ETFN	2	90.9	0.0	.57	.59
207	MMFA	1	84.0	0.0	.44	0.00
~~204~~	~~MM2~~	~~1~~	83.3	0.0	.39	0.00
105	ET3	2	88.0	0.0	.38	.54
104	ET2	3	87.5	0.0	.24	.41
~~303~~	~~FR~~	~~1~~	79.0	0.0	.22	0.00
103	ET1	1	[illegible]	[illegible]	.00	0.00

APPENDIX G

Individual Noise Exposure Results for All 12 Ships Using Individual Location Noise Level Data Averaged Over All 12 Ships

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
~~EXCHANGE RATE = 5 DBA~~

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL W.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE W.C.
60400	LCDR	1	****	77.3 ****	.00	.02
~~60304~~	~~ENS~~	~~1~~	~~85.3~~	~~91.1~~	~~.52~~	1.17
60303	ENS	1	82.9	84.4	.37	.45
60302	ENS	1	74.5	77.4	.12	.15
~~60301~~	~~ENS~~	~~1~~	~~83.8~~	~~87.1~~	.42	.67
60300	ENS	1	86.1	89.3	.58	.91
60207	LTJG	1	72.1	74.5	.08	.11
~~60206~~	~~LTJG~~	~~1~~	~~74.5~~	~~77.8~~	.11	.16
60205	LTJG	1	75.3	81.1	.13	.29
60204	LTJG	1	83.7	88.1	.42	.58
60203	LTJG	1	80.3	81.7	.26	.31
60202	LTJG	1	71.5	75.6	.05	.14
60201	LTJG	1	80.3	82.5	.26	.33
~~60200~~	~~LTJG~~	~~1~~	87.2	90.6	.68	1.00
60105	LT	1	74.3	77.6	.11	.16
60104	LT	1	90.9	94.1	1.13	1.70
~~60103~~	~~LT~~	~~1~~	~~76.1~~	~~79.9~~	.19	.25
60102	LT	1	80.2	86.8	.26	.27
60101	LT	1	****	****	.00	0.00
~~60100~~	~~LT~~	~~1~~	~~64.1~~	~~66.7~~	.03	.04
50601	ENFN	1	****	****	.00	0.00
50600	ENFN	1	98.6	101.2	3.31	4.72
~~50506~~	~~EN3~~	~~1~~	~~87.6~~	~~92.7~~	~~.74~~	1.45
50505	EN3	1	95.3	97.9	1.59	3.00
50504	EN3	1	95.3	101.1	2.09	4.67
~~50503~~	~~EN3~~	~~1~~	~~93.8~~	~~95.3~~	~~1.11~~	2.08
50502	EN3	1	90.2	94.4	1.02	1.83
50501	EN3	1	88.7	92.9	.64	1.49
~~50500~~	~~EN3~~	~~1~~	~~92.6~~	~~97.7~~	~~1.46~~	2.90
50400	EN2	1	82.9	87.6	.37	.72
50304	EN1	1	93.2	95.9	1.56	2.26
~~50303~~	~~EN1~~	~~1~~	~~95.6~~	~~97.6~~	~~2.16~~	2.67
50302	EN1	1	90.5	92.4	1.08	1.39
50301	EN1	1	91.9	95.9	1.31	2.27
~~50300~~	~~EN1~~	~~1~~	81.3	86.0	.30	.57
40700	EMFA	1	75.9	75.2	.11	.13

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
~~EXCHANGE RATE = 5 DBA~~

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL L.E.Q.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE L.E.Q.
40602	EMFN	1	82.6	84.7	.36	.48
~~40601~~	~~EMFA~~	~~1~~	~~85.4~~	~~87.8~~	~~.53~~	~~.74~~
40600	EMFN	1	[illegible]	[illegible]	.00	0.00
40505	EM3	1	76.5	77.0	.15	.17
~~40504~~	~~EM3~~	~~1~~	~~81.1~~	~~83.1~~	~~.29~~	~~.39~~
40503	EM3	1	80.8	82.3	.28	.34
40502	EM3	1	[illegible]	[illegible]	.00	0.00
~~40501~~	~~EM3~~	~~1~~	~~77.9~~	~~80.5~~	~~.19~~	~~.27~~
40500	EM3	1	84.9	86.9	.49	.65
40403	EM2	1	75.8	77.5	.14	.18
40402	EM2	1	77.1	79.8	.17	.24
40401	EM2	1	81.8	84.7	.32	.48
40400	EM2	1	85.7	90.2	.55	1.02
~~40302~~	~~EM1~~	~~1~~	~~80.3~~	~~86.1~~	~~.26~~	~~.58~~
40301	EM1	1	87.0	88.6	.66	.82
40300	EM1	1	95.1	99.9	2.02	3.96
~~40200~~	~~EMC~~	~~1~~	~~88.9~~	~~91.2~~	~~.85~~	~~1.18~~
30301	FR	1	76.4	79.9	.15	.25
30300	FR	1	83.2	85.2	.39	.51
~~30202~~	~~FA~~	~~1~~	~~97.1~~	~~100.2~~	~~2.67~~	~~4.09~~
30201	FA	1	83.2	85.2	.39	.51
30200	FA	1	[illegible]	[illegible]	.00	0.00
~~30107~~	~~FN~~	~~1~~	~~85.8~~	~~91.0~~	~~.56~~	~~1.14~~
30106	FN	1	69.3	72.8	.06	.09
30105	FN	1	80.3	86.1	.26	.58
~~30104~~	~~FN~~	~~1~~	~~83.9~~	~~87.1~~	~~.43~~	~~.67~~
30103	FN	1	81.0	82.2	.29	.34
30102	FN	1	81.1	86.1	.29	.58
~~30101~~	~~FN~~	~~1~~	~~82.4~~	~~84.5~~	~~.35~~	~~.47~~
30100	FN	2	85.9	86.5	.57	.62
21000	MMCS	1	72.9	74.5	.09	.12
~~20901~~	~~MM~~	~~1~~	~~84.0~~	~~86.1~~	~~.43~~	~~.58~~
20900	MP	1	86.2	88.1	.59	.77
20800	MMFP	1	86.7	90.2	.64	1.02
~~20708~~	~~MMFA~~	~~1~~	~~79.0~~	~~81.1~~	~~.22~~	~~.29~~
20707	MMFA	1	90.0	91.2	1.00	1.18

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
~~EXCHANGE RATE = 5 DBA~~

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL W.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE W.C.
20706	MMFA	1	83.3	86.0	.39	.57
~~20705~~	~~MMFA~~	~~1~~	~~77.5~~	~~79.8~~	.16	.24
20704	MMFA	1	84.6	85.7	.47	.55
20703	MMFA	1	86.1	87.2	.58	.66
~~20702~~	~~MMFA~~	1	~~92.8~~	~~94.7~~	1.47	1.92
20701	MMFA	3	87.9	89.2	.75	.90
20700	MMFA	3	85.4	90.5	.53	1.07
~~20630~~	~~MMFN~~	~~1~~	~~77.4~~	~~79.9~~	.17	.25
20629	MMFN	1	82.9	85.4	.37	.40
20628	MMFN	1	92.5	93.5	1.42	1.63
~~20627~~	~~MMFN~~	1	87.4	89.2	.69	.90
20626	MMFN	1	87.0	87.8	.66	.74
20625	MMFN	1	81.8	82.7	.32	.37
~~20624~~	~~MMFN~~	~~1~~	~~89.8~~	91.4	.98	1.21
20623	MMFN	1	79.2	81.7	.22	.32
20622	MMFN	1	80.9	82.6	.29	.36
~~20621~~	~~MMFN~~	~~1~~	~~86.6~~	~~87.4~~	.63	.70
20620	MMFN	1	89.1	90.6	.86	1.09
20619	MMFN	1	88.7	89.5	.84	.94
~~20618~~	~~MMFN~~	~~1~~	~~83.6~~	85.5	.41	.52
20617	MMFN	1	75.6	76.9	.14	.16
20616	MMFN	1	****	****	.00	0.00
~~20615~~	~~MMFN~~	~~1~~	~~90.8~~	~~91.8~~	1.11	1.24
20614	MMFN	1	87.0	87.5	.65	.70
20613	MMFN	1	93.4	95.5	1.61	2.15
~~20612~~	~~MMFN~~	~~1~~	~~87.5~~	~~88.6~~	.70	.82
20611	MMFN	1	89.3	95.4	.91	1.61
20610	MMFN	1	81.4	84.9	.30	.49
~~20609~~	~~MMFN~~	~~2~~	~~86.4~~	89.3	.65	.90
20608	MMFN	1	81.2	83.9	.30	.43
20607	MMFN	2	69.9	75.3	.06	.20
~~20606~~	~~MMFN~~	~~1~~	~~75.9~~	~~79.6~~	.16	.24
20605	MMFN	1	71.3	76.0	.07	.14
20604	MMFN	2	83.1	87.1	.39	.67
~~20603~~	~~MMFN~~	2	~~83.0~~	84.6	.38	.46
20602	MMFN	2	89.9	93.6	.96	1.64

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL MAX.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE MAX.
20601	MMFN	1	89.8	92.3	.98	1.19
20600	MMFN	5	88.6	91.2	.83	1.15
20535	MM3	1	88.3	89.6	.79	.97
20534	MM3	2	75.9	83.3	.21	.40
20533	MM3	1	90.5	92.5	1.04	1.07
20532	MM3	2	81.2	85.9	.29	.56
20531	MM3	2	86.9	90.6	.65	1.12
20530	MM3	1	83.1	83.5	.38	.41
20529	MM3	1	86.8	90.2	.64	1.02
20528	MM3	1	82.7	91.4	.37	1.22
20527	MM3	1	86.0	88.1	.64	.76
20526	MM3	1	77.5	79.5	.18	.24
20525	MM3	3	90.1	93.0	1.02	1.32
20524	MM3	1	85.1	86.4	.51	.58
20523	MM3	1	85.0	85.5	.50	.53
20522	MM3	1	90.7	92.0	1.11	1.15
20521	MM3	1	86.9	87.3	.65	.69
20520	MM3	1	80.7	82.7	.27	.36
20519	MM3	1	88.3	89.4	.79	.92
20518	MM3	1	78.2	84.0	.20	.44
20517	MM3	1	90.9	93.2	1.13	1.50
20516	MM3	1	84.0	86.1	.43	.58
20515	MM3	1	86.1	87.2	.58	.65
20514	MM3	1	85.2	85.5	.51	.54
20513	MM3	1	90.9	91.7	1.13	1.27
20512	MM3	1	85.2	86.9	.52	.65
20511	MM3	3	****	****	.00	0.00
20510	MM3	1	85.3	85.6	.52	.56
20509	MM3	2	81.4	84.9	.30	.49
20508	MM3	3	89.6	90.9	.95	1.14
20507	MM3	1	87.6	88.1	.71	.76
20506	MM3	1	79.4	80.9	.23	.28
20505	MM3	1	81.9	84.0	.33	.47
20504	MM3	2	86.5	8[illegible].4	.61	.60
20503	MM3	5	84.5	87.7	.47	.72
20502	MM3	1	86.1	87.7	.59	.73

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL MAX.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE MAX.
20501	MM3	2	88.9	95.0	.65	2.09
20500	MM3	2	87.8	93.8	.73	1.65
20423	MM2	1	82.8	83.4	.37	.40
20422	MM2	1	73.2	75.2	.10	.13
20421	MM2	1	89.5	90.4	.94	1.06
20420	MM2	1	92.8	93.3	1.47	1.59
20419	MM2	1	****	****	.00	0.00
20418	MM2	1	82.7	84.3	.38	.45
20417	MM2	1	86.0	87.1	.57	.67
20416	MM2	1	84.7	86.5	.48	.62
20415	MM2	1	87.1	87.9	.67	.74
20414	MM2	1	91.1	92.4	1.16	1.40
20413	MM2	1	90.2	92.1	1.04	1.34
20412	MM2	1	86.6	88.2	.62	.75
20411	MM2	1	88.2	90.2	.78	1.02
20410	MM2	1	86.6	87.0	.64	.66
20409	MM2	1	93.2	97.6	1.57	2.66
20408	MM2	1	81.4	84.9	.30	.49
20407	MM2	1	90.1	91.2	1.01	1.18
20406	MM2	1	88.4	88.4	.61	.80
20405	MM2	1	81.3	82.3	.30	.35
20404	MM2	1	86.9	87.9	.65	.74
20403	MM2	2	****	****	.00	.14
20402	MM2	1	85.2	85.6	.52	.54
20401	MM2	1	83.9	85.4	.43	.53
20400	MM2	2	83.2	87.1	.39	.67
20309	MM1	1	89.8	90.5	.97	1.07
20308	MM1	1	77.5	78.4	.16	.20
20307	MM1	1	79.6	80.3	.24	.26
20306	MM1	1	94.5	96.1	1.65	2.33
20305	MM1	1	87.0	87.7	.66	.73
20304	MM1	1	86.5	88.2	.62	.75
20303	MM1	1	****	****	.00	0.00
20302	MM1	1	72.1	73.1	.08	.10
20301	MM1	1	87.0	88.0	.71	.82
20300	MM1	1	87.6	88.9	.72	.86

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL W.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE W.C.
20204	MMC	1	82.8	87.7	.57	.72
20203	MMC	1	[illegible]	[illegible]	.00	0.00
20202	MMC	1	83.0	84.3	.38	.45
20201	MMC	1	84.9	88.5	.49	.61
20200	MMC	1	92.8	95.4	1.47	2.12
10901	BT	1	[illegible]	[illegible]	.00	0.00
10900	BT	1	85.1	87.5	.50	.71
10804	BTFR	1	91.2	92.3	1.17	1.37
10803	BTFR	1	89.9	91.4	.99	1.21
10802	BTFR	1	90.1	91.2	1.01	1.16
10801	BTFR	1	78.0	83.1	.19	.35
10800	BTFR	1	84.5	89.5	.47	.94
10714	BTFA	1	92.9	94.4	1.45	1.53
10713	BTFA	1	87.0	91.8	.80	1.24
10712	BTFA	1	88.2	88.8	.59	.84
10711	BTFA	1	85.8	91.0	.56	1.14
10710	BTFA	1	87.2	89.0	.86	.87
10709	BTFA	1	89.2	90.4	.89	1.05
10708	BTFA	1	91.2	93.4	1.18	1.61
10707	BTFA	2	88.9	91.9	.85	1.31
10706	BTFA	1	92.7	96.3	1.40	2.45
10705	BTFA	2	90.1	95.2	1.01	2.05
10704	BTFA	1	87.1	87.4	.67	.69
10703	BTFA	1	[illegible]	[illegible]	.00	0.00
10702	BTFA	1	71.0	73.3	.07	.10
10701	BTFA	1	70.3	74.8	.15	.24
10700	BTFA	3	91.3	96.4	1.21	2.42
10633	BTFN	1	83.9	88.2	.43	.59
10632	BTFA	1	88.5	96.8	.81	1.06
10631	BTFN	1	87.3	90.1	.69	1.01
10630	BTFN	1	77.3	70.8	.17	.21
10629	BTFN	1	94.8	96.3	1.89	2.41
10628	BTFN	1	92.3	94.0	1.38	1.90
10627	BTFN	1	83.1	85.2	.36	.52
10626	BTFA	1	85.9	87.8	.50	.72
10625	BTFN	1	84.5	84.8	.40	.49

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL W.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE W.C.
10624	BTFN	1	88.3	90.3	.79	1.05
10623	BTFN	1	87.9	89.1	.75	.89
10622	BTFN	1	94.9	96.3	1.97	2.41
10621	BTFN	1	90.0	90.5	1.00	1.07
10620	BTFN	1	88.7	91.3	.54	1.19
10619	BTFN	1	91.3	92.5	1.15	1.41
10618	BTFN	1	89.8	93.2	.97	1.56
10617	BTFN	2	87.8	89.3	.74	.97
10616	BTFN	1	91.[illegible]	92.7	1.25	1.45
10615	BTFN	1	89.1	90.7	.88	1.10
10614	BTFN	1	83.7	88.3	.41	.80
10613	BTFN	6	90.2	91.9	1.03	1.30
10612	BTFN	1	90.6	92.0	1.12	1.32
10611	BTFN	1	90.0	90.0	1.00	1.00
10610	BTFN	1	92.9	95.0	1.49	2.01
10609	BTFN	1	92.3	94.0	1.38	1.90
10608	BTFN	1	84.0	87.1	.43	.67
10607	BTFN	2	88.1	93.0	.77	1.52
10606	BTFN	1	88.4	89.9	.64	.86
10605	BTFN	1	89.7	92.3	.46	1.37
10604	BTFN	1	75.4	78.3	.13	.18
10603	BTFN	1	86.4	85.0	.61	.78
10602	BTFN	7	87.1	94.5	.67	1.67
10601	BTFN	4	89.1	93.1	.68	1.54
10600	BTFN	3	[illegible]	[illegible]	.00	0.00
10529	BT3	1	85.2	88.9	.52	.85
10528	BT3	1	89.7	92.2	.97	1.38
10527	BT3	1	78.3	81.1	.20	.29
10526	BT3	1	95.8	98.5	2.16	2.45
10525	BT3	1	82.3	84.4	.34	.48
10524	BT3	1	87.7	91.3	.72	1.19
10523	BT3	1	88.8	91.0	.65	1.24
10522	BT3	1	90.7	92.0	1.10	1.32
10521	BT3	1	88.0	89.0	.70	.80
10520	BT3	1	87.8	89.4	.74	.92
10519	BT3	1	80.0	87.0	.57	.74

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL U.C.L.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE U.C.L.
10518	BT3	1	83.8	85.5	.42	.53
10517	BT3	1	84.0	87.1	.43	.57
10516	BT3	1	90.1	92.7	1.01	1.10
10515	BT3	1	76.4	81.5	.20	.31
10514	BT3	1	88.3	89.4	.79	.92
10513	BT3	1	81.3	85.8	.30	.42
10512	BT3	1	81.4	82.8	.30	.37
10511	BT3	2	78.5	84.9	.20	.49
10510	BT3	1	89.4	91.0	.92	1.15
10509	BT3	1	91.6	93.5	1.25	1.64
10508	BT3	1	88.4	93.0	.80	1.39
10507	BT3	2	85.1	88.3	.51	.88
10506	BT3	2	89.9	92.3	.95	1.37
10505	BT3	2	87.7	90.4	.73	1.00
10504	BT3	1	93.7	97.2	1.60	2.72
10503	BT3	1	79.5	84.5	.23	.47
10502	BT3	4	92.9	96.1	1.50	2.34
10501	BT3	0	****	****	.00	0.00
10500	BT3	4	86.4	89.5	.61	.94
10413	BT2	1	90.1	91.2	1.02	1.10
10412	BT2	1	85.9	88.7	.57	.83
10411	BT2	1	88.1	89.2	.77	.89
10410	BT2	1	87.6	90.0	.71	1.01
10409	BT2	1	86.3	89.2	.60	.90
10408	BT2	1	91.6	94.1	1.25	1.77
10407	BT2	3	85.3	89.0	.52	.87
10406	BT2	1	80.7	85.4	.28	.46
10405	BT2	1	87.5	88.1	.71	.76
10404	BT2	1	83.6	85.0	.41	.54
10403	BT2	1	93.3	97.3	1.56	2.75
10402	BT2	4	79.5	87.0	.23	.72
10401	BT2	1	89.5	94.5	.93	1.87
10400	BT2	0	****	****	.00	0.00
10309	BT1	1	83.7	85.9	.42	.88
10308	BT1	2	81.1	87.9	.29	.75
10307	BT1	1	77.8	79.8	.15	.23

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
~~EXCHANGE RATE = 5 DBA~~

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.L.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.L.
10306	ET1	1	76.1	79.9	.19	.25
~~10305~~	~~ET1~~	~~1~~	~~70.4~~	~~72.0~~	.07	.09
10304	ET1	1	62.7	67.6	.36	.71
10303	ET1	1	65.2	66.9	.52	.65
~~10302~~	~~ET1~~	~~1~~	~~65.1~~	~~67.3~~	.50	.60
10301	ET1	2	69.7	90.1	.96	2.34
10300	ET1	1	[illegible]	[illegible]	.00	0.00
~~10206~~	~~ETC~~	~~1~~	~~68.1~~	~~60.8~~	.77	.65
10205	ETC	1	60.9	62.4	.26	.35
10204	ETC	1	[illegible]	[illegible]	.00	0.00
10203	ETC	1	64.5	64.5	.47	.99
10202	ETC	1	72.4	77.4	.09	.16
10201	ETC	1	91.4	95.1	1.22	1.54
~~10200~~	~~ETC~~	~~1~~	[illegible]	[illegible]	.00	0.00
10100	ETCM	1	77.1	79.3	.17	.23

APPENDIX H

Individual Noise Exposure Results for Each Ship Using Sub-area Average Noise Levels

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1083 USS COOK

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL W.C.	DAILY NOISE DOS. MEAN	DAILY NOISE DOS. W.C.
60200	LTJG	1	71.1	72.7	.07	.09
20700	MMFA	1	81.6	84.0	.31	.43
20601	MMFN	1	76.0	77.3	.14	.17
20600	MMFN	1	81.6	82.8	.31	.37
20501	MM3	1	81.6	84.0	.31	.43
20500	MM3	1	85.3	87.7	.52	.72
20401	MM2	1	83.9	84.7	.43	.48
20400	MM2	1	74.8	77.3	.12	.17
20301	MM1	1	90.2	90.9	1.02	1.13
20300	MM1	1	85.0	85.4	.50	.53
10702	BTFA	1	90.3	91.2	1.04	1.19
10701	BTFA	1	85.3	85.6	.52	.54
10700	BTFA	1	84.0	85.1	.44	.50
10602	BTFN	1	81.1	82.6	.29	.36
10601	BTFN	1	85.5	86.0	.53	.58
10600	BTFN	1	85.5	86.2	.54	.59
10500	BT3	1	84.0	85.6	.43	.54
10403	BT2	1	86.7	86.0	.63	.62
10402	BT2	1	92.3	93.8	1.37	1.70
10401	BT2	1	84.[illegible]	85.2	.45	.51
10400	BT2	1	87.3	88.0	.69	.76

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1065 USS STEIN

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL MAX.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE MAX.
50502	EN3	1	####	####	.00	0.00
50501	EN3	1	####	####	.00	0.00
50500	EN3	1	####	####	.00	0.00
50300	EN1	1	####	####	.00	0.00
30201	FA	1	####	####	.00	0.00
30200	FA	1	81.7	83.1	.32	.38
30100	FN	1	87.2	88.6	.60	.83
20602	MMFN	1	94.5	95.4	1.67	2.10
20601	MMFN	1	90.9	93.5	1.15	1.82
20600	MMFN	1	89.5	91.1	.93	1.16
20505	MM3	1	86.0	89.8	.75	.97
20504	MM3	1	92.8	94.0	1.40	1.74
20503	MM3	1	83.0	84.6	.38	.49
20502	MM3	1	88.4	90.1	.80	1.01
20501	MM3	1	89.7	90.3	.83	1.04
20500	MM3	1	76.0	77.8	.19	.24
20402	MM2	1	88.7	89.0	.84	.95
20401	MM2	1	91.4	92.6	1.21	1.40
20400	MM2	1	87.3	91.5	.69	1.24
20302	MM1	1	79.0	81.4	.24	.30
20301	MM1	1	91.9	92.5	1.30	1.41
20300	MM1	1	87.0	88.7	.72	.85
20200	MMC	1	####	####	.00	0.00
10701	BTFA	1	87.2	88.8	.66	.85
10700	BTFA	1	87.3	89.3	.69	.91
10602	BTFN	1	85.4	88.0	.53	.83
10601	BTFN	1	75.4	78.0	.15	.14
10600	BTFN	1	90.3	92.0	1.04	1.40
10502	BT3	1	91.2	91.4	1.19	1.22
10501	BT3	1	77.3	79.9	.17	.25
10500	BT3	1	92.0	94.0	1.44	1.73
10400	BT2	1	87.3	89.9	.69	.99
10300	BT1	1	87.2	88.3	.66	.79
10200	BTC	1	80.8	82.8	.04	.04

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1084 USS CANDLESS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL W.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE W.C.
60202	LTJG	1	72.1	75.4	.06	.13
60201	LTJG	1	80.3	85.0	.26	.41
60200	LTJG	1	84.1	86.2	.44	.59
60100	LT	1	72.1	75.4	.08	.13
50501	EN3	1	94.8	96.1	1.95	3.00
50500	EN3	1	96.1	99.4	2.34	3.70
50300	EN1	1	99.1	102.4	3.52	5.55
40500	EM3	1	75.0	75.5	.12	.13
40400	EM2	1	91.1	94.1	1.16	1.76
40200	EMC	1	89.3	91.3	.90	1.20
30300	FR	1	74.2	77.5	.11	.16
30102	FN	1	67.1	70.4	.04	.07
30101	FN	1	85.3	88.6	.52	.82
30100	FN	1	80.0	80.6	.25	.27
20700	MMFA	1	85.2	87.2	.77	.79
20603	MMFN	1	85.3	87.1	.52	.67
20602	MMFN	1	71.6	74.4	.06	.11
20601	MMFN	1	85.7	92.6	.64	1.32
20600	MMFN	1	88.1	90.2	.77	1.03
20504	MM3	1	85.7	86.2	.55	.59
20503	MM3	1	83.4	85.5	.40	.53
20502	MM3	1	86.0	87.3	.58	.69
20501	MM3	1	75.0	78.1	.13	.14
20500	MM3	1	87.3	87.4	.69	.92
20401	MM2	1	****	****	.00	.28
20400	MM2	1	****	****	.00	.04
10701	BTFA	1	83.5	86.4	.41	.61
10700	BTFA	1	87.4	90.3	.70	1.04
10606	BTFN	1	83.4	85.0	.40	.50
10605	BTFN	1	86.2	89.7	.54	.96
10604	BTFN	1	79.4	79.7	.23	.24
10603	BTFN	1	82.8	83.5	.37	.41
10602	BTFN	1	81.6	83.4	.31	.43
10601	BTFN	1	84.2	85.0	.45	.50
10600	BTFN	1	82.5	84.0	.37	.47
10501	BT3	1	78.0	79.6	.21	.24

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1084 USS CANDLESS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL W.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE W.C.
10500	ET3	1	83.0	85.0	.38	.50
10400	ET2	1	81.7	82.3	.32	.34
10300	ET1	1	83.5	86.4	.41	.61
10201	ETC	1	79.8	80.5	.24	.27
10200	ETC	1	74.5	77.4	.12	.17

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
~~EXCHANGE RATE~~ = 5 DBA

FF-1090 USS AINSWORTH

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.C.
60100	LT	1	93.6	96.6	1.65	2.49
40601	EMFN	1	81.6	83.5	.31	.41
~~40600~~	~~EMFN~~	~~1~~	~~85.6~~	~~88.8~~	~~.55~~	~~.85~~
40500	EM3	1	81.6	83.5	.31	.41
20700	MMFA	1	79.6	82.7	.24	.37
~~20602~~	~~MMFN~~	~~1~~	~~74.6~~	~~77.7~~	~~.12~~	~~.16~~
20601	MMFN	1	81.6	83.5	.31	.41
20600	MMFN	1	87.9	88.3	.74	.79
~~20502~~	~~MM3~~	~~1~~	~~93.8~~	~~97.6~~	~~1.52~~	~~2.43~~
20501	MM3	1	80.6	85.5	.63	.62
20500	MM3	1	90.0	91.6	1.09	1.29
20402	MM2	1	88.6	88.5	.63	.72
20401	MM2	1	83.4	85.1	.46	.56
20400	MM2	1	87.6	87.9	.71	.75
~~10703~~	~~BTFA~~	~~1~~	~~85.6~~	~~85.5~~	~~.56~~	~~.82~~
10702	BTFA	1	82.6	83.7	.36	.42
10701	BTFA	1	84.9	86.5	.50	.61
~~10700~~	~~BTFA~~	~~1~~	~~77.3~~	~~86.5~~	~~.23~~	~~.27~~
10600	BTFN	1	83.9	86.2	.43	.55
10500	BT3	1	81.5	83.4	.31	.40
~~10400~~	~~BT2~~	~~1~~	~~82.6~~	~~85.5~~	~~.36~~	~~.41~~
10200	BTC	1	84.7	86.3	.46	.79

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1091 USS MILLER

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.D.
60200	LTJG	1	76.0	77.4	.14	.17
60100	LT	1	74.4	76.1	.11	.15
46300	EM1	1	****	****	.00	0.00
20601	MMFN	1	93.8	93.3	1.12	1.58
20600	MMFN	1	88.5	92.1	.81	1.10
20401	MM2	1	89.3	90.8	.90	1.08
20400	MM2	1	89.5	92.2	.94	1.30
20300	MM1	1	87.8	88.6	.71	.82
20200	MMC	1	91.1	94.0	1.10	1.73
10702	ETFA	1	88.0	92.3	.85	1.30
10701	ETFA	1	87.9	90.5	.75	1.05
10700	ETFA	1	80.9	84.2	.28	.44
10607	ETFN	1	92.2	92.6	1.15	1.45
10606	ETFN	1	80.0	85.4	.22	.30
10605	ETFN	1	87.4	87.7	.75	.90
10604	ETFN	1	83.3	85.1	.40	.51
10603	ETFN	1	89.0	91.4	.94	1.22
10602	ETFN	1	86.9	88.8	.65	.83
10601	ETFN	1	86.9	88.8	.65	.73
10600	ETFN	1	83.5	86.1	.41	.50
10501	ET3	1	87.0	88.2	.60	.78
10500	ET3	1	83.3	85.1	.40	.51
10402	ET2	1	87.2	90.4	.68	1.00
10401	ET2	1	89.5	92.8	.94	1.40
10400	ET2	1	89.4	92.4	.92	1.40
10301	ET1	1	87.5	91.0	.70	1.14
10300	ET1	1	86.8	87.1	.65	.80
10200	ETC	1	88.6	93.1	.82	1.31

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1097 USS MOINESTER

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.L.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.L.
40500	EM3	1	76.9	78.3	.16	.20
40400	EM2	1	79.6	81.2	.24	.30
40300	EM1	1	83.2	89.6	.39	.47
20702	MMFA	1	81.7	85.8	.32	.42
20701	MMFA	1	81.2	85.9	.29	.43
20700	MMFA	1	87.0	88.8	.88	.53
20504	MM3	1	83.8	88.2	.43	.59
20503	MM3	1	70.2	81.0	.20	.29
20502	MM3	1	91.0	92.9	1.15	1.49
20501	MM3	1	84.9	85.9	.49	.58
20500	MM3	1	83.3	83.7	.40	.42
20400	MM2	1	88.1	89.3	.77	.91
20300	MM1	1	83.1	88.8	.38	.57
20200	MMC	1	85.8	88.5	.55	.82
10700	BTFA	1	94.0	97.8	1.89	2.94
10603	BTFN	1	93.7	92.0	1.10	1.47
10602	BTFN	1	95.1	96.1	2.34	3.09
10601	BTFN	1	93.7	95.8	1.88	2.15
10600	BTFN	1	90.5	94.3	1.08	1.82
10503	BT3	1	90.8	92.5	1.12	1.41
10502	BT3	1	89.9	91.4	.95	1.21
10501	BT3	1	95.1	98.3	2.04	2.41
10500	BT3	1	93.4	94.5	1.01	1.00
10401	BT2	1	90.4	99.9	1.06	1.97
10400	BT2	1	90.8	93.5	1.12	1.22
10300	BT1	1	95.8	100.3	2.23	4.15
10200	BTC	1	95.2	95.5	2.38	3.23

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1094 USS PHARRIS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.C.
50300	EN1	1	****	****	.00	0.00
40700	EMFA	1	74.1	74.6	.11	.12
~~40501~~	~~EM3~~	~~1~~	~~****~~	~~****~~	.00	0.00
40500	EM3	1	74.7	75.6	.12	.14
40400	EM2	1	79.3	79.6	.23	.24
~~30100~~	~~FN~~	~~1~~	~~82.7~~	83.3	.38	.43
20602	MMFN	1	89.4	90.2	.92	1.02
20601	MMFN	1	86.5	87.3	.61	.69
~~20600~~	~~MMFN~~	~~1~~	~~85.5~~	~~87.3~~	.54	.68
20507	MM3	1	88.4	91.1	.80	1.16
20506	MM3	1	87.3	89.9	.69	.98
20505	MM3	1	87.3	89.9	.69	.98
20504	MM3	1	89.7	90.7	.96	1.10
20503	MM3	1	86.1	88.9	.58	.65
~~20502~~	~~MM3~~	~~1~~	~~87.9~~	~~88.0~~	.75	.76
20501	MM3	1	72.3	74.9	.09	.12
20500	MM3	1	****	****	.00	0.00
~~20401~~	~~MM2~~	~~1~~	~~87.3~~	89.8	.69	.97
20400	MM2	1	89.7	90.7	.96	1.10
20300	MM1	1	87.4	87.6	.70	.72
~~10802~~	~~BTFN~~	~~1~~	~~90.1~~	~~92.1~~	1.02	1.33
10801	BTFN	1	90.3	91.1	1.05	1.15
10800	BTFN	1	90.1	90.9	1.02	1.13
~~10607~~	~~BTFN~~	~~1~~	~~89.9~~	~~92.2~~	.99	1.35
10606	BTFN	1	89.9	92.2	.99	1.35
10605	BTFN	1	89.9	92.2	.99	1.35
~~10604~~	~~BTFN~~	~~1~~	~~89.9~~	~~92.2~~	.99	1.35
10603	BTFN	1	90.2	91.0	1.03	1.15
10602	BTFN	1	89.9	92.2	.99	1.35
~~10601~~	~~BTFN~~	~~1~~	~~88.8~~	~~91.6~~	.83	1.14
10600	BTFN	1	89.8	93.2	.98	1.63
10503	BT3	1	90.1	92.8	1.01	1.47
~~10502~~	~~BT3~~	~~1~~	~~85.2~~	~~87.9~~	.51	.75
10501	BT3	1	89.9	92.2	.99	1.35
10500	BT3	1	90.1	92.8	1.01	1.47
10401	BT2	1	90.2	90.4	1.03	1.05

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1094 USS PHARRIS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL R.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE R.C.
10400	ET2	1	89.9	90.1	.98	1.01
10301	ET1	1	90.2	90.3	1.02	1.05
10300	ET1	1	71.0	73.0	.07	.09

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1085 USS BEARY

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL W.C.	DAILY NOISE DOS. MEAN	DAILY NOISE DOS. W.C.
60301	ENS	1	91.9	95.1	1.51	2.03
60300	ENS	1	87.4	88.3	.70	.79
60200	LTJG	1	74.0	77.6	.12	.16
60100	LT	1	84.7	84.9	.46	.49
50600	ENFN	1	97.0	100.9	2.94	4.56
50500	EN3	1	100.2	103.2	4.09	6.25
50300	EN1	1	98.5	102.7	3.27	5.05
40600	EMFN	1	96.9	100.1	2.61	4.05
40500	EM3	1	85.6	90.0	.62	1.00
40400	EM2	1	89.2	92.3	.89	1.30
30200	FA	1	96.9	100.1	2.61	4.05
30100	FR	1	88.8	92.4	.84	1.39
20901	MM	1	87.3	89.2	.69	.88
20900	MM	1	85.2	87.9	.52	.74
20700	MMFA	1	89.4	92.2	.92	1.16
20602	MMFN	1	81.4	84.2	.30	.45
20601	MMFN	1	90.5	91.5	1.08	1.22
20600	MMFA	1	85.0	87.8	.57	.73
20503	MM3	1	87.3	89.1	.69	.86
20502	MM3	1	85.2	87.9	.52	.74
20501	MM3	1	92.0	93.3	1.32	1.55
20500	MM3	1	92.3	94.1	1.38	1.76
20402	MM2	1	99.9	103.0	3.92	6.08
20401	MM2	1	81.5	85.3	.40	.60
20400	MM2	1	93.4	95.2	1.60	2.06
20200	MMC	1	93.1	95.2	1.53	2.07
10901	BT	1	90.8	94.5	1.12	1.66
10900	BT	1	89.0	91.5	.85	1.23
10700	BTFA	1	90.6	94.5	1.12	1.65
10600	BTFA	1	87.9	91.5	.75	1.24
10505	BT3	1	97.6	101.0	2.86	4.57
10504	BT3	1	92.2	93.7	1.36	1.67
10503	BT3	1	90.6	94.5	1.12	1.66
10502	BT3	1	85.2	87.9	.52	.74
10501	BT3	1	89.0	91.5	.86	1.23
10500	BT3	1	94.9	95.3	1.97	2.09

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1085 USS BEARY

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL		DAILY NOISE DOSE	
			MEAN	R.O.	MEAN	R.O.
10301	ET1	1	87.1	90.7	.67	1.10
10300	ET1	1	90.6	91.4	1.09	1.21

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1092 USS HART

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.C.
60200	LTJG	1	79.3	81.0	.23	.27
21000	MMCS	1	89.2	92.5	.89	1.42
20800	MMFR	1	87.3	88.8	.69	.84
20700	MMFA	1	93.4	94.7	1.60	1.91
20602	MMFN	1	83.0	85.2	.38	.51
20601	MMFN	1	89.1	91.1	.89	1.10
20600	MMFN	1	90.5	90.9	1.07	1.13
20504	MM3	1	90.2	93.0	1.03	1.52
20503	MM3	1	83.2	88.0	.78	.85
20502	MM3	1	88.7	90.8	.83	1.08
20501	MM3	1	92.5	95.9	1.42	2.28
20500	MM3	1	83.5	88.9	.40	.85
10605	BTFN	1	83.4	85.2	.40	.51
10604	BTFN	1	83.7	88.8	.42	.53
10603	BTFN	1	70.8	72.7	.07	.09
10602	BTFN	1	88.5	90.7	.82	1.10
10601	BTFN	1	85.2	88.1	.51	.58
10600	BTFN	1	68.5	72.9	.05	.05
10505	BT3	1	78.5	80.7	.20	.27
10504	BT3	1	88.5	87.7	.62	.73
10503	BT3	1	85.6	87.7	.54	.73
10502	BT3	1	89.8	91.8	.95	1.25
10501	BT3	1	84.8	87.2	.49	.67
10500	BT3	1	85.9	88.0	.57	.83
10401	BT2	1	91.5	93.0	1.22	1.64
10400	BT2	1	75.6	77.7	.14	.20
10300	BT1	1	83.7	88.0	.42	.58
10100	BTCM	1	84.7	85.5	.48	.53

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1081 USS AYLWIN

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.L.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.L.
60301	ENS	1	90.2	93.0	1.03	1.32
60300	ENS	1	84.4	85.2	.46	.51
60200	LTJG	1	85.9	86.1	.57	.59
60100	LT	1	90.9	93.8	1.13	1.69
50600	ENFN	1	88.0	91.5	.63	1.30
50500	EN3	1	79.3	84.6	.23	.47
40300	EM1	1	86.9	91.0	.65	1.15
20605	MMFN	1	85.5	87.4	.52	.70
20604	MMFN	1	90.0	92.2	1.00	1.38
20603	MMFN	1	88.5	89.5	.80	.94
20602	MMFN	1	82.5	85.5	.34	.54
20601	MMFN	1	86.9	92.1	.65	1.34
20600	MMFN	1	88.7	92.8	.83	1.28
20506	MM3	1	87.5	90.5	.68	1.07
20505	MM3	1	85.9	86.1	.57	.58
20504	MM3	1	88.7	89.0	.83	.87
20503	MM3	1	81.7	84.0	.32	.44
20502	MM3	1	87.5	90.5	.68	1.07
20501	MM3	1	81.7	84.0	.32	.44
20500	MM3	1	88.7	89.0	.83	.87
20404	MM2	1	87.3	90.5	.68	1.07
20403	MM2	1	81.7	83.2	.31	.35
20402	MM2	1	86.0	86.6	.57	.65
20401	MM2	1	75.2	77.7	.13	.18
20400	MM2	1	85.3	85.8	.52	.55
20300	MM1	1	88.2	89.5	.78	.93
10601	BTFN	1	91.9	92.3	1.25	1.38
10600	BTFN	1	92.5	95.4	1.41	2.11
10505	BT3	1	92.1	94.9	1.35	1.98
10504	BT3	1	90.3	91.6	1.04	1.24
10503	BT3	1	90.4	91.7	1.06	1.27
10502	BT3	1	90.4	91.7	1.06	1.27
10501	BT3	1	90.3	91.6	1.04	1.24
10500	BT3	1	92.1	94.9	1.35	1.98
10400	BT2	1	94.7	98.7	1.91	2.55
10300	BT1	1	89.9	92.2	.99	1.40

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1097 USS MOINESTER

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL W.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE W.C.
60400	LCDR	1	[redacted]	[redacted]	.00	0.00
60300	ENS	1	82.7	84.7	.37	.46
60100	LT	1	83.0	83.0	.63	.63
50400	EN2	1	67.5	70.9	.04	.07
50300	EN1	1	75.9	79.3	.14	.23
30102	FN	1	84.0	88.1	.44	.77
30101	FN	1	85.0	86.0	.50	.57
30100	FN	1	85.0	86.0	.50	.57
20703	MMFA	1	85.6	87.7	.55	.72
20702	MMFA	1	75.6	77.7	.14	.18
20701	MMFA	1	85.6	87.7	.55	.72
20700	MMFA	1	85.5	87.7	.55	.72
20607	MMFN	1	79.3	80.3	.23	.23
20606	MMFN	1	82.7	85.9	.30	.43
20605	MMFN	1	81.8	[illegible]	.31	.38
20604	MMFN	1	70.4	75.4	.15	.20
20603	MMFN	1	55.9	57.3	.01	.01
20602	MMFN	1	85.8	87.2	.56	.73
20601	MMFN	1	79.3	80.5	.23	.27
20600	MMFN	1	82.7	85.9	.30	.43
20506	MM3	1	88.8	88.8	.62	.54
20505	MM3	1	81.4	82.9	.30	.37
20504	MM3	1	84.3	85.7	.49	.55
20503	MM3	1	82.9	84.2	.32	.45
20502	MM3	1	79.3	81.3	.23	.33
20501	MM3	1	88.1	87.2	.58	.66
20500	MM3	1	77.9	80.0	.19	.25
20401	MM2	1	84.8	85.3	.46	.52
20400	MM2	1	81.7	83.7	.32	.42
20300	MM1	1	88.3	87.8	.66	.72
20200	MMC	1	90.1	91.0	1.01	1.29
10801	BTFR	1	75.7	76.6	.14	.16
10800	BTFR	1	80.1	90.2	.36	1.03
10701	BTFA	1	70.4	72.5	.07	.09
10700	BTFA	1	77.0	77.9	.16	.19
10600	BTFN	1	75.4	75.2	.15	.16

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1097 USS MOINESTER

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL W.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE W.C.
10605	ETFN	1	89.0	93.1	.88	1.55
10604	ETFN	1	84.0	88.1	.44	.77
10603	ETFN	1	90.1	94.3	1.02	1.81
10602	ETFN	1	87.9	90.9	.74	1.13
10601	ETFN	1	90.1	94.3	1.02	1.81
10600	ETFN	1	89.0	93.1	.88	1.55
10507	ET3	1	87.7	91.8	.73	1.29
10506	ET3	1	91.2	95.3	1.19	2.09
10505	ET3	1	80.9	84.8	.22	.39
10504	ET3	1	81.1	85.2	.29	.52
10503	ET3	1	91.0	91.8	1.15	1.25
10502	ET3	1	91.5	95.7	1.23	2.45
10501	ET3	1	91.5	95.7	1.23	2.45
10500	ET3	1	87.7	91.8	.73	1.29
10403	ET2	1	89.0	93.1	.88	1.55
10402	ET2	1	94.0	98.1	1.75	3.09
10401	ET2	1	91.5	95.7	1.24	2.19
10400	ET2	1	89.0	93.1	.88	1.55
10200	ETC	1	70.0	72.1	.00	.00

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1075 USS TRIPPE

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.L.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.L.
30300	FR	1	82.1	84.6	.34	.48
20700	MMFA	1	87.1	89.6	.67	.95
20602	MMFN	1	87.1	89.6	.67	.95
20601	MMFN	1	88.3	89.7	.79	.96
20600	MMFN	1	89.9	91.7	.96	1.26
20500	MM3	1	89.7	91.0	.95	1.15
20400	MM2	1	83.3	85.1	.39	.51
10700	BTFA	1	90.5	93.0	1.07	1.51
10601	BTFN	1	88.1	90.0	.77	.99
10600	BTFN	1	87.5	90.0	.71	1.01
10501	BT3	1	90.5	93.0	1.07	1.51
10500	BT3	1	85.1	87.0	.51	.66
10402	BT2	1	90.5	93.0	1.07	1.51
10401	BT2	1	87.5	90.0	.71	1.01
10400	BT2	1	85.5	88.0	.53	.75
10300	BT1	1	85.5	83.0	.53	.75

APPENDIX I

Grade Average Noise Exposure Results for Each Ship Using Sub-area Average Noise Levels

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1083 USS COOK

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
104	BT2	4	87.0	3.4	.79	.45
203	MM1	2	87.6	3.6	.76	.37
107	BTFA	3	86.5	3.3	.67	.33
106	BTFN	3	84.0	2.5	.45	.24
105	BT3	1	84.0	0.0	.43	0.00
205	MM3	2	85.5	2.0	.42	.15
207	MMFA	1	81.6	0.0	.31	0.00
204	MM2	2	79.4	6.4	.27	.22
206	MMFN	2	76.5	3.9	.23	.12
602	LTJG	1	71.1	0.0	.07	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1065 USS STEIN

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
206	MMFN	3	91.6	2.6	1.31	.50
105	ET3	3	87.1	6.5	.93	.67
204	MM2	3	89.1	2.0	.91	.27
203	MM1	3	86.4	6.3	.75	.53
205	MM3	6	86.1	5.1	.71	.45
104	ET2	1	87.3	0.0	.69	0.00
107	ETFA	2	87.2	.0	.66	.00
301	FN	1	87.2	0.0	.66	0.00
103	ET1	1	87.2	0.0	.66	0.00
102	ETC	1	86.8	0.0	.64	0.00
106	ETFN	3	84.0	7.0	.57	.44
302	FA	2	81.7	0.0	.16	.22
202	MMC	1	****	****	.00	0.00
503	EN1	1	****	****	.00	0.00
505	EN3	3	****	****	.00	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1084 USS CANDLESS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOS. MEAN	DAILY NOISE DOS. S.D.
503	EN1	1	99.1	0.0	3.52	0.00
505	EN3	2	95.5	.9	2.15	.26
404	EM2	1	91.1	0.0	1.16	0.00
402	EMC	1	89.3	0.0	.90	0.00
207	MMFA	1	88.2	0.0	.77	0.00
107	ETFA	2	85.4	2.7	.55	.29
206	MMFN	4	83.4	6.0	.55	.34
205	MM3	5	83.5	4.9	.47	.22
103	ET1	1	83.5	0.0	.41	0.00
106	ETFN	7	82.9	2.1	.34	.11
104	ET2	1	81.7	0.0	.32	0.00
105	ET3	2	80.8	3.1	.29	.12
301	FN	3	77.5	9.4	.27	.24
602	LTJG	3	78.8	8.1	.26	.13
102	ETC	2	77.1	3.8	.26	.09
405	EM3	1	75.0	0.0	.12	0.00
303	FR	1	74.2	0.0	.11	0.00
601	ET	1	72.1	0.0	.08	0.00
204	MM2	2	****	****	.00	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1090 USS AINSWORTH

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
601	LT	1	93.0	0.0	1.05	0.00
205	MM3	3	90.1	3.2	1.06	.45
204	MM2	3	85.9	2.2	.58	.16
102	BTC	1	84.7	0.0	.48	0.00
106	BTFN	1	83.9	0.0	.43	0.00
406	EMFN	2	83.0	2.8	.43	.18
107	BTFA	4	83.2	2.9	.41	.15
206	MMFN	3	81.4	0.5	.39	.32
104	BT2	1	82.6	0.0	.36	0.00
405	EM3	1	81.6	0.0	.31	0.00
105	BT3	1	81.5	0.0	.31	0.00
207	MMFA	1	79.6	0.0	.29	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1091 USS MILLER

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
202	MMC	1	91.1	0.0	1.16	0.00
206	MMFN	2	89.7	1.6	.97	.22
204	MM2	2	89.4	.2	.92	.02
104	ET2	3	88.7	1.3	.85	.14
203	MM1	1	87.6	0.0	.71	0.00
106	ETFN	6	87.0	2.7	.70	.26
103	ET1	2	87.2	.4	.67	.04
107	ETFA	3	85.9	4.3	.63	.30
102	ETC	1	86.6	0.0	.62	0.00
105	ET3	2	85.2	2.6	.53	.15
602	LTJG	1	76.0	0.0	.14	0.00
601	LT	1	74.4	0.0	.11	0.00
403	EM1	1	[illegible]	[illegible]	.00	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1097 USS MOINESTER

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
102	BTC	1	96.2	0.0	2.30	0.00
103	BT1	1	95.8	0.0	2.23	0.00
~~107~~	~~BTFA~~	~~1~~	~~94.5~~	0.0	1.89	0.00
106	BTFN	4	92.8	2.7	1.35	.62
105	BT3	4	92.3	2.4	1.44	.40
~~104~~	~~BT2~~	2	~~90.8~~	.3	1.09	.09
204	MM2	1	88.1	0.0	.77	0.00
202	MMC	1	85.8	0.0	.55	0.00
~~205~~	~~MM3~~	~~5~~	~~84.3~~	4.8	.53	.36
207	MMFA	3	83.3	3.2	.42	.20
403	EM1	1	83.2	0.0	.39	0.00
203	~~MM1~~	1	83.1	0.0	.36	0.00
404	EM2	1	79.6	0.0	.24	0.00
405	EM3	1	76.9	0.0	.16	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1094 USS PHARRIS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
108	BTFR	3	90.2	.1	1.03	.02
104	BT2	2	90.0	.2	1.00	.03
106	BTFN	2	89.8	.5	.97	.05
105	BT3	4	88.8	2.4	.88	.25
204	MM2	2	88.5	1.7	.83	.20
203	MM1	1	87.4	0.0	.76	0.00
206	MMFN	3	87.1	2.0	.69	.20
205	MM3	6	85.6	5.9	.57	.34
103	BT1	2	80.6	13.6	.55	.57
301	FN	1	82.7	0.0	.38	0.00
404	EM2	1	79.3	0.0	.23	0.00
407	EMFN	1	74.1	0.0	.11	0.00
405	EM3	2	74.7	0.0	.06	.06
503	EN1	1	****	****	.00	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1085 USS BEARY

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
505	EN3	1	100.2	0.0	4.09	0.00
503	EN1	1	98.5	0.0	3.27	0.00
502	ENFN	1	97.3	0.0	2.94	0.00
302	FA	1	96.9	0.0	2.61	0.00
406	EMFN	1	96.9	0.0	2.61	0.00
204	MM2	4	92.2	3.3	1.98	1.79
202	MMC	1	95.1	0.0	1.53	0.00
105	ET3	6	91.0	4.4	1.45	.55
107	ETFA	1	90.8	0.0	1.12	0.00
603	EN3	2	89.7	3.2	1.00	.43
109	ET	2	89.9	1.3	1.00	.17
205	MM3	4	89.2	3.3	.98	.44
207	MMFA	1	89.4	0.0	.92	0.00
404	EM2	1	89.2	0.0	.89	0.00
103	ET1	2	86.9	.5	.86	.30
301	FN	1	88.8	0.0	.84	0.00
405	EM3	1	88.6	0.0	.82	0.00
106	ETFN	1	87.9	0.0	.75	0.00
206	MMFN	3	86.0	4.0	.65	.35
209	MM	2	86.3	1.5	.60	.12
601	ET	1	84.7	0.0	.48	0.00
602	ETJG	1	74.6	0.0	.12	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1092 USS HART

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
207	MMFA	1	93.4	0.0	1.00	0.00
205	MM3	5	85.6	3.3	.69	.37
210	MMCS	1	86.2	0.0	.69	0.00
206	MMFN	3	87.5	4.0	.78	.36
203	MMFR	1	87.3	0.0	.69	0.00
104	EI2	2	83.5	[illegible]	.68	.77
105	ET3	6	85.2	3.7	.56	.24
101	ETCM	1	84.7	0.0	.46	0.00
103	ET1	1	83.7	0.0	.42	0.00
100	ETFN	6	85.0	6.3	.36	.29
602	ETJG	1	79.3	0.0	.23	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1081 USS AYLWIN

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
104	GT2	1	94.7	0.0	1.91	0.00
106	GTFN	2	92.2	.4	1.55	.06
105	GT3	6	90.9	.9	1.15	.15
601	LT	1	90.9	0.0	1.13	0.00
103	GT1	1	89.9	0.0	.99	0.00
403	EM1	1	88.9	0.0	.85	0.00
203	MM1	1	88.2	0.0	.78	0.00
603	ENS	2	87.3	4.1	.75	.40
206	MMFN	6	86.9	2.9	.69	.25
506	ENFN	1	86.5	0.0	.63	0.00
602	LTJG	1	85.9	0.0	.57	0.00
205	MM3	7	85.3	2.5	.55	.18
204	MM2	5	83.1	4.7	.44	.22
505	EN3	1	79.3	0.0	.23	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1097 USS MOINESTER

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
104	ET2	4	90.9	2.4	1.18	.41
202	MMC	1	90.1	0.0	1.01	0.00
105	ET3	6	88.8	3.5	.92	.33
106	ETFN	7	86.5	5.3	.73	.33
203	MM1	1	86.3	0.0	.60	0.00
301	FN	3	84.7	.8	.48	.04
207	MMFA	4	83.1	5.0	.44	.20
204	MM2	2	83.2	2.1	.40	.12
205	MM3	7	82.7	3.4	.40	.17
603	ENS	1	82.7	0.0	.37	0.00
108	ETFR	2	80.9	7.4	.35	.32
208	MMFN	6	78.0	9.4	.25	.18
503	EN1	1	75.9	0.0	.14	0.00
107	ETFA	2	73.7	4.7	.12	.07
102	ETC	1	70.0	0.0	.06	0.00
504	EN2	1	67.5	0.0	.04	0.00
601	LT	1	63.8	0.0	.03	0.00
604	LCDR	1	[redacted]	[redacted]	.00	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1075 USS TRIPPE

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
107	ETFA	1	90.5	0.0	1.07	0.00
205	MM3	1	89.7	0.0	.95	0.00
206	EMFA	3	88.4	1.4	.82	.16
105	ET3	2	87.8	3.6	.79	.39
104	ET2	3	87.6	2.5	.77	.27
166	ETFA	2	87.2	.4	.74	.04
207	MMFA	1	87.1	0.0	.67	0.00
103	ET1	1	85.5	0.0	.53	0.00
204	MM2	1	83.3	0.0	.39	0.00
303	FR	1	82.1	0.0	.34	0.00

APPENDIX J

Individual Noise Exposure Results for All 12 Ships Using Sub-area Averages over All 12 Ships For the Noise Level Data

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL N.L.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE N.L.
60400	LCDR	1	50.0	64.3	.00	.03
60304	ENS	1	65.3	91.1	.32	1.17
60303	ENS	1	63.6	84.9	.41	.49
60302	ENS	1	80.9	95.7	.65	1.58
60301	ENS	1	80.0	88.5	.58	.82
60300	ENS	1	80.1	89.3	.53	.91
60207	LTJG	1	72.3	75.3	.09	.13
60206	LTJG	1	74.3	77.5	.11	.18
60205	LTJG	1	75.3	81.1	.13	.29
60204	LTJG	1	83.7	86.1	.42	.58
60203	LTJG	1	82.3	84.7	.28	.31
60202	LTJG	1	71.5	73.5	.09	.14
60201	LTJG	1	81.3	83.3	.30	.39
60200	LTJG	1	87.7	94.3	.72	1.53
60105	LT	1	74.3	77.8	.11	.18
60104	LT	1	90.9	94.1	1.13	1.78
60103	LT	1	78.1	79.9	.19	.25
60102	LT	1	81.2	81.5	.30	.31
60101	LT	1	89.5	94.5	.93	1.87
60100	LT	1	84.2	88.7	.03	.04
50601	ENFN	1	91.2	97.0	1.17	2.63
50600	ENFN	1	97.0	103.4	2.87	6.42
50506	EN3	1	93.2	99.0	1.57	3.50
50505	EN3	1	95.3	101.1	2.09	4.67
50504	EN3	1	95.8	104.8	3.39	7.59
50503	EN3	1	89.3	95.7	.98	2.19
50502	EN3	1	91.2	97.0	1.17	2.63
50501	EN3	1	93.8	99.3	1.70	3.83
50500	EN3	1	90.3	96.1	1.14	2.54
50400	EN2	1	81.9	87.7	.33	.73
50304	EN1	1	93.2	99.0	1.57	3.50
50303	EN1	1	94.1	99.9	1.76	3.94
50302	EN1	1	95.3	101.1	2.09	4.67
50301	EN1	1	91.9	97.7	1.31	2.92
50300	EN1	1	90.3	96.1	1.14	2.54
40700	EMFA	1	74.1	75.8	.11	.14

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL R.M.S.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE R.M.S.
40602	EMFN	1	82.0	84.7	.38	[illegible]
40601	EMFN	1	83.4	[illegible]	.53	.74
40600	EMFN	1	90.3	96.1	1.04	2.34
40505	EM3	1	77.4	77.9	.17	.19
40504	EM3	1	86.6	[illegible]	.38	.40
40503	EM3	1	80.0	82.3	.22	.34
40502	EM3	1	70.3	70.1	.07	.15
40501	EM3	1	77.9	80.5	.19	.27
40500	EM3	1	84.9	88.9	.49	.65
40403	EM2	1	87.2	92.0	.68	[illegible]
40402	EM2	1	77.3	[illegible]	.27	[illegible]
40401	EM2	1	82.5	[illegible]	.38	.52
40400	EM2	1	83.7	[illegible]	.55	1.02
40302	EM1	1	[illegible]	[illegible]	.28	.55
40301	EM1	1	87.0	88.0	.66	.72
40300	EM1	1	95.1	99.9	2.02	3.98
40200	EMC	1	88.9	91.2	.85	1.18
30301	FR	1	70.4	79.9	.15	.25
30300	FR	1	80.3	83.0	.26	.38
30202	FA	1	95.3	111.1	2.09	4.07
30201	FA	1	82.2	85.1	.34	.38
30200	FA	1	90.3	96.1	1.04	2.34
30108	FN	1	90.2	93.4	1.02	1.61
30107	FN	1	69.3	72.8	.06	.09
30106	FN	1	80.3	80.1	.20	.55
30105	FN	1	85.0	82.9	.50	.65
30104	FN	1	81.3	82.5	.30	.35
30103	FN	1	85.4	90.4	.53	1.05
30102	FN	1	82.4	87.4	.35	.70
30101	FN	1	86.3	87.9	.60	.75
30100	FN	1	86.3	87.9	.60	.75
21000	MMCS	1	87.4	87.7	.70	.73
20901	MM	1	85.5	87.0	.54	.72
20900	MM	1	83.2	85.9	.39	.57
20800	MMFA	1	88.7	92.2	.64	1.02
20712	MMFA	1	80.5	82.5	.27	.30

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL R.M.S.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE R.M.S.
20711	MMFA	1	90.0	91.2	1.00	1.16
20710	MMFA	1	83.7	86.6	.41	.63
20709	MMFA	1	84.9	87.3	.50	.66
20708	MMFA	1	83.2	85.9	.39	.57
20707	MMFA	1	85.5	87.6	.54	.72
20706	MMFA	1	87.6	89.7	.72	.96
20705	MMFA	1	92.2	93.4	1.36	1.59
20704	MMFA	1	80.2	85.0	.39	.65
20703	MMFA	1	78.2	78.8	.15	.21
20702	MMFA	1	85.2	88.8	.39	.55
20701	MMFA	1	83.2	86.2	.39	.55
20700	MMFA	1	85.3	88.0	.52	.75
20639	MMFN	1	78.2	83.9	.20	.26
20638	MMFN	1	83.8	88.5	.42	.61
20637	MMFN	1	92.5	93.5	1.42	1.65
20636	MMFN	1	89.1	91.7	.89	1.27
20635	MMFN	1	87.5	89.4	.71	.92
20634	MMFN	1	87.1	89.2	.67	.90
20633	MMFN	1	81.5	82.8	.31	.36
20632	MMFN	1	90.0	94.4	1.14	1.84
20631	MMFN	1	90.0	92.3	1.00	1.35
20630	MMFN	1	75.7	81.0	.21	.31
20629	MMFN	1	82.6	84.7	.36	.46
20628	MMFN	1	88.4	89.5	.80	.90
20627	MMFN	1	91.0	94.0	1.24	1.66
20626	MMFN	1	88.2	91.9	.78	1.13
20625	MMFN	1	88.4	89.3	.80	.99
20624	MMFN	1	84.7	88.0	.48	.57
20623	MMFN	1	84.3	86.0	.45	.64
20622	MMFN	1	79.3	82.8	.23	.37
20621	MMFN	1	88.5	89.7	.82	.98
20620	MMFN	1	84.2	86.3	.45	.65
20619	MMFN	1	87.1	89.6	.67	.95
20618	MMFN	1	90.4	91.9	1.06	1.33
20617	MMFN	1	93.8	95.5	1.69	2.23
20616	MMFN	1	85.4	87.9	.53	.75

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL R.M.S.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE R.M.S.
20615	MMFN	1	88.5	91.5	.81	1.23
20614	MMFN	1	85.5	88.9	.53	.66
20613	MMFN	1	81.4	84.9	.30	.49
20612	MMFN	1	88.0	91.5	.76	1.23
20611	MMFN	1	89.1	91.7	.89	1.27
20610	MMFN	1	81.8	84.8	.31	.47
20609	MMFN	1	83.4	84.9	.40	.50
20608	MMFN	1	82.4	85.9	.35	.49
20607	MMFN	1	70.9	75.0	.10	.24
20606	MMFN	1	70.3	76.1	.07	.15
20605	MMFN	1	88.1	88.7	.58	.63
20604	MMFN	1	80.5	82.0	.27	.30
20603	MMFN	1	83.4	84.9	.40	.50
20602	MMFN	1	85.3	88.0	.52	.75
20601	MMFN	1	89.2	91.5	.89	1.23
20600	MMFN	1	90.8	93.3	1.11	1.58
20552	MM3	1	80.5	82.6	.27	.30
20551	MM3	1	84.2	86.3	.45	.60
20550	MM3	1	87.0	89.7	.72	.98
20549	MM3	1	90.4	92.2	1.16	1.47
20548	MM3	1	82.8	84.7	.36	.48
20547	MM3	1	89.3	92.0	.91	1.32
20546	MM3	1	85.2	89.0	.59	.87
20545	MM3	1	77.0	79.7	.18	.24
20544	MM3	1	88.3	88.8	.79	.84
20543	MM3	1	85.9	87.9	.57	.75
20542	MM3	1	87.9	89.3	.75	.91
20541	MM3	1	84.3	84.7	.45	.48
20540	MM3	1	89.3	91.5	.90	1.24
20539	MM3	1	82.7	91.4	.37	[illegible]
20538	MM3	1	87.0	89.7	.72	.98
20537	MM3	1	90.9	92.8	1.08	1.47
20536	MM3	1	88.9	89.5	.85	.93
20535	MM3	1	80.3	83.0	.20	.38
20534	MM3	1	89.5	91.8	.93	1.29
20533	MM3	1	85.4	86.7	.53	.63

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL R.M.S.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE R.M.S.
20532	MM3	1	85.5	88.0	.53	.57
20531	MM3	1	90.4	92.5	1.06	1.47
20530	MM3	1	86.4	89.9	.61	.90
20529	MM3	1	86.4	89.9	.61	.90
20528	MM3	1	87.6	89.7	.72	.96
20527	MM3	1	85.2	88.0	.52	.62
20526	MM3	1	87.5	88.7	.70	.85
20525	MM3	1	85.6	88.2	.57	.51
20524	MM3	1	95.3	101.1	2.09	4.67
20523	MM3	1	85.5	87.8	.54	.72
20522	MM3	1	83.2	85.9	.39	.57
20521	MM3	1	90.1	92.7	1.02	1.20
20520	MM3	1	90.5	92.0	1.07	1.44
20519	MM3	1	89.9	91.4	.99	1.22
20518	MM3	1	92.0	92.7	1.32	1.46
20517	MM3	1	87.6	89.2	.71	.90
20516	MM3	1	90.5	91.9	1.22	1.72
20515	MM3	1	82.4	84.9	.30	.49
20514	MM3	1	86.4	89.9	.61	.92
20513	MM3	1	86.2	88.9	.64	.86
20512	MM3	1	86.9	89.0	.65	.94
20511	MM3	1	81.9	84.0	.33	.47
20510	MM3	1	86.4	89.9	.61	.92
20509	MM3	1	81.9	84.0	.33	.47
20508	MM3	1	86.9	89.0	.65	.94
20507	MM3	1	87.6	88.1	.71	.77
20506	MM3	1	83.7	86.6	.41	.63
20505	MM3	1	85.7	87.4	.55	.69
20504	MM3	1	84.2	86.3	.45	.60
20503	MM3	1	79.8	82.5	.24	.35
20502	MM3	1	86.6	88.3	.65	.79
20501	MM3	1	79.3	82.0	.23	.37
20500	MM3	1	90.5	92.0	1.07	1.44
20425	MM2	1	82.9	85.8	.37	.42
20424	MM2	1	75.3	77.9	.14	.29
20423	MM2	1	89.1	90.0	.88	1.00

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.C.
20422	MM2	1	91.6	92.6	1.26	1.47
20421	MM2	1	88.4	89.9	.81	.96
20420	MM2	1	81.0	83.1	.29	.38
20419	MM2	1	86.9	89.0	.64	.85
20418	MM2	1	87.6	89.7	.72	.96
20417	MM2	1	85.3	88.0	.52	.75
20416	MM2	1	88.2	88.9	.76	.88
20415	MM2	1	89.3	90.9	.90	1.14
20414	MM2	1	90.5	92.6	1.07	1.44
20413	MM2	1	86.6	88.2	.62	.7[illegible]
20412	MM2	1	85.3	88.0	.52	.75
20411	MM2	1	87.6	89.7	.72	.9[illegible]
20410	MM2	1	93.2	95.6	1.57	[illegible]
20409	MM2	1	83.4	84.9	.30	.49
20408	MM2	1	91.6	93.7	1.25	1.66
20407	MM2	1	88.4	89.9	.81	.95
20406	MM2	1	80.9	82.0	.26	.33
20405	MM2	1	85.9	88.7	.57	.84
20404	MM2	1	74.9	77.0	.12	.16
20403	MM2	1	85.1	88.7	.50	.83
20402	MM2	1	84.8	86.2	.49	.59
20401	MM2	1	83.1	84.0	.33	.47
20400	MM2	1	84.1	86.7	.44	.63
20309	MM1	1	89.2	90.0	.89	.9[illegible]
20308	MM1	1	88.4	88.6	.81	.85
20307	MM1	1	79.2	83.3	.22	.33
20306	MM1	1	92.4	93.0	1.40	1.52
20305	MM1	1	87.9	89.0	.75	.87
20304	MM1	1	87.6	88.9	.72	.88
20303	MM1	1	85.5	88.9	.53	.88
20302	MM1	1	86.5	88.8	.62	.84
20301	MM1	1	89.2	91.3	.89	1.20
20300	MM1	1	87.6	89.7	.72	.96
20204	MMC	1	80.3	85.1	.26	.50
20203	MMC	1	91.4	94.5	1.22	1.97
20202	MMC	1	84.9	85.9	.49	.57

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL MAX.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE MAX.
20201	MMC	1	88.5	91.9	.61	1.30
20200	MMC	1	92.8	95.4	1.47	2.12
10901	BT	1	87.4	92.4	.70	1.40
10900	BT	1	85.2	88.2	.51	.75
10804	BTFR	1	93.3	97.3	1.56	2.75
10803	BTFR	1	92.7	95.7	1.46	1.67
10802	BTFR	1	92.8	94.7	1.47	1.91
10801	BTFR	1	75.6	[illegible]	.19	.35
10800	BTFR	1	84.5	89.5	.47	.94
10718	BTFA	1	92.7	96.3	1.45	2.41
10717	BTFA	1	87.7	93.0	.72	.57
10716	BTFA	1	88.2	90.2	.59	[illegible]
10715	BTFA	1	93.2	95.4	1.62	[illegible]
10714	BTFA	1	93.5	94.8	1.67	1.95
10713	BTFA	1	80.5	93.0	.62	1.64
10712	BTFA	1	92.4	97.4	1.40	2.81
10711	BTFA	1	89.1	92.0	.89	1.33
10710	BTFA	1	89.9	92.8	.99	1.45
10709	BTFA	1	91.3	95.5	1.19	1.63
10708	BTFA	1	85.5	89.8	.53	.97
10707	BTFA	1	93.1	96.2	1.55	3.10
10706	BTFA	1	92.9	95.3	1.49	2.03
10705	BTFA	1	85.5	88.4	.54	.61
10704	BTFA	1	89.7	95.3	.95	1.55
10703	BTFA	1	87.4	92.4	.70	1.40
10702	BTFA	1	73.8	78.0	.17	.19
10701	BTFA	1	79.3	84.4	.23	.40
10700	BTFA	1	92.4	97.4	1.40	2.81
10651	BTFN	1	83.7	88.9	.42	.88
10650	BTFN	1	87.9	90.3	.74	1.04
10649	BTFN	1	88.4	90.1	.80	1.02
10648	BTFN	1	87.3	90.3	.69	1.04
10647	BTFN	1	79.2	82.9	.22	.37
10646	BTFN	1	93.7	95.9	1.67	3.43
10645	BTFN	1	87.9	91.1	.75	1.12
10644	BTFN	1	90.7	94.5	1.11	1.80

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL [illegible]	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE [illegible]
10643	ETFN	1	83.5	84.8	.41	.49
10642	ETFN	1	87.5	90.0	.71	1.00
10641	ETFN	1	85.5	88.5	.54	.81
10640	ETFN	1	89.2	90.1	.90	1.01
10639	ETFN	1	87.0	88.8	.66	.85
10638	ETFN	1	88.5	89.6	.81	.95
10637	ETFN	1	94.9	96.3	1.97	2.41
10636	ETFN	1	90.5	93.5	1.07	1.62
10635	ETFN	1	91.8	94.8	1.29	1.95
10634	ETFN	1	88.7	91.3	.84	1.19
10633	ETFN	1	92.4	94.3	1.40	1.82
10632	ETFN	1	90.8	93.0	1.11	1.52
10631	ETFN	1	90.8	93.8	1.11	1.69
10630	ETFN	1	89.8	93.0	.97	1.52
10629	ETFN	1	86.0	87.8	.57	.74
10628	ETFN	1	91.5	93.4	1.23	1.61
10627	ETFN	1	89.1	90.7	.88	1.10
10626	ETFN	1	88.4	90.3	.81	1.05
10625	ETFN	1	90.2	93.2	1.03	1.56
10624	ETFN	1	90.2	93.2	1.03	1.56
10623	ETFN	1	90.2	93.2	1.03	1.56
10622	ETFN	1	90.2	93.2	1.03	1.56
10621	ETFN	1	92.6	93.7	1.44	1.66
10620	ETFN	1	90.2	93.2	1.03	1.56
10619	ETFN	1	91.7	96.4	1.26	2.44
10618	ETFN	1	92.1	92.6	1.33	1.44
10617	ETFN	1	84.5	89.5	.47	.94
10616	ETFN	1	86.7	93.9	.63	1.71
10615	ETFN	1	85.2	88.0	.51	.76
10614	ETFN	1	74.5	79.5	.12	.23
10613	ETFN	1	92.4	97.4	1.40	2.81
10612	ETFN	1	88.4	92.3	.80	1.38
10611	ETFN	1	86.4	87.9	.64	.85
10610	ETFN	1	89.6	94.4	.95	1.83
10609	ETFN	1	91.1	96.1	1.17	2.34
10608	ETFN	1	75.4	78.6	.13	.21

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL MAX.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE MAX.
10607	8TFN	1	87.4	92.4	.70	1.40
10606	8TFN	1	82.4	87.4	.35	.70
10605	8TFN	1	86.5	93.0	.62	1.04
10604	8TFN	1	86.8	89.8	.64	.97
10603	8TFN	1	86.5	93.0	.62	1.04
10602	8TFN	1	87.4	92.4	.70	1.40
10601	8TFN	1	90.2	93.2	1.03	1.56
10600	8TFN	1	89.5	94.5	.93	1.87
10544	8T3	1	85.2	88.2	.51	.78
10543	8T3	1	94.0	94.2	1.74	1.80
10542	8T3	1	80.2	86.0	.26	.57
10541	8T3	1	95.5	95.7	2.16	3.33
10540	8T3	1	82.9	87.9	.37	.47
10539	8T3	1	87.7	91.3	.72	1.19
10538	8T3	1	87.5	90.2	.70	1.03
10537	8T3	1	90.7	92.6	1.11	1.32
10536	8T3	1	87.3	92.3	.69	1.04
10535	8T3	1	86.5	91.5	.61	1.23
10534	8T3	1	88.1	90.7	.77	1.10
10533	8T3	1	90.3	91.3	1.04	1.20
10532	8T3	1	86.7	89.6	.63	.94
10531	8T3	1	92.4	97.4	1.40	2.81
10530	8T3	1	86.7	91.9	.63	1.71
10529	8T3	1	90.2	93.2	1.03	1.58
10528	8T3	1	92.4	97.4	1.40	2.81
10527	8T3	1	94.4	95.8	1.85	1.94
10526	8T3	1	88.3	92.0	.79	1.09
10525	8T3	1	87.4	92.4	.70	1.40
10524	8T3	1	83.2	85.9	.39	.57
10523	8T3	1	85.2	88.2	.51	.78
10522	8T3	1	91.4	92.0	1.21	1.32
10521	8T3	1	82.4	87.4	.35	.70
10520	8T3	1	89.4	93.0	.93	1.51
10519	8T3	1	89.5	94.5	.93	1.87
10518	8T3	1	93.5	96.0	1.63	3.22
10517	8T3	1	86.5	89.5	.62	.91

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL R.M.S.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE R.M.S.
10516	ET3	1	90.8	95.0	1.12	2.50
10515	ET3	1	90.0	95.0	1.11	2.26
10514	ET3	1	89.0	91.5	.88	1.20
10513	ET3	1	88.9	91.4	.86	1.22
10512	ET3	1	88.9	91.4	.86	1.22
10511	ET3	1	89.0	91.3	.88	1.20
10510	ET3	1	90.8	96.0	1.11	2.26
10509	ET3	1	88.1	91.1	.58	1.17
10508	ET3	1	91.6	96.6	1.25	2.57
10507	ET3	1	90.3	91.6	1.05	1.29
10506	ET3	1	71.5	84.5	.43	.47
10505	ET3	1	92.9	99.0	1.49	1.69
10504	ET3	1	93.4	96.2	1.60	2.33
10503	ET3	1	93.0	96.1	1.68	2.33
10502	ET3	1	88.1	91.1	.95	1.17
10501	ET3	1	92.4	97.4	1.40	2.81
10500	ET3	1	87.3	96.3	.69	1.94
10423	ET2	1	89.0	94.1	.88	1.75
10422	ET2	1	92.8	95.2	1.40	2.07
10421	ET2	1	87.0	83.5	.66	.93
10420	ET2	1	90.2	92.2	1.03	1.35
10419	ET2	1	90.8	96.0	1.11	2.20
10418	ET2	1	80.8	87.4	.64	.69
10417	ET2	1	90.0	92.6	1.00	1.43
10416	ET2	1	91.5	90.2	1.24	1.35
10415	ET2	1	93.0	98.2	1.70	3.29
10414	ET2	1	93.6	96.1	1.66	3.05
10413	ET2	1	85.4	96.4	.53	1.65
10412	ET2	1	85.2	86.4	.51	.80
10411	ET2	1	93.0	95.3	1.52	1.57
10410	ET2	1	92.2	92.5	1.35	1.41
10409	ET2	1	95.4	100.9	2.10	4.21
10408	ET2	1	79.5	84.5	.23	.47
10407	ET2	1	93.3	97.3	1.58	2.75
10406	ET2	1	87.4	92.4	.76	1.42
10405	ET2	1	92.4	97.4	1.40	2.81

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.L.	DAILY NOISE DOS. MEAN	DAILY NOISE DOS. M.L.
10404	ET2	1	89.9	95.0	.99	1.99
10403	ET2	1	87.4	92.4	.70	1.40
10402	ET2	1	92.4	97.4	1.40	2.01
10401	ET2	1	89.5	94.5	.93	1.87
10400	ET2	1	87.4	92.4	.70	1.40
10311	ET1	1	90.0	92.0	1.00	1.44
10310	ET1	1	88.5	93.0	.82	1.64
10309	ET1	1	91.5	96.8	1.26	2.57
10308	ET1	1	91.0	91.3	1.15	1.20
10307	ET1	1	90.7	95.8	1.11	2.22
10306	ET1	1	92.5	[illegible]	1.42	1.47
10305	ET1	1	72.3	74.1	.09	.11
10304	ET1	1	83.7	[illegible]	.42	.53
10303	ET1	1	80.9	[illegible]	.65	.77
10302	ET1	1	83.2	86.2	.51	.72
10301	ET1	1	88.5	93.0	.82	1.64
10300	ET1	1	87.4	92.4	.70	1.40
10206	ETC	1	90.0	94.3	1.00	1.65
10205	ETC	1	84.8	85.5	.46	.54
10204	ETC	1	79.3	84.5	.23	.47
10203	ETC	1	89.5	94.5	.93	1.87
10202	ETC	1	90.9	95.9	1.14	2.25
10201	ETC	1	91.4	93.1	1.22	1.54
10200	ETC	1	71.4	74.9	.06	.11
10100	ETCM	1	88.0	92.1	.75	1.34

APPENDIX K

Individual Noise Exposure Results for Each Ship Using General Area Average Noise Levels

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1083 USS COOK

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL W.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE W.C.
60200	LTJG	1	72.2	74.0	.06	.11
20700	MMFA	1	82.9	85.4	.36	.53
20601	MMFN	1	79.2	[illegible]	.22	.37
20600	MMFN	1	84.7	86.5	.48	.81
20501	MM3	1	82.9	85.4	.38	.55
20500	MM3	1	86.6	89.1	.63	[illegible]
20401	MM2	1	84.2	86.3	.45	.60
20400	MM2	1	76.2	80.0	.15	.25
20301	MM1	1	90.9	93.3	1.13	1.50
20300	MM1	1	85.5	88.0	.54	.57
10702	BTFA	1	89.6	91.7	.97	1.26
10701	BTFA	1	85.1	87.8	.51	[illegible]
10700	BTFA	1	83.5	[illegible]	.42	.55
10602	BTFN	1	80.1	82.0	.21	.33
10601	BTFN	1	[illegible]	[illegible]	.51	[illegible]
10600	BTFN	1	84.5	86.3	.47	.60
10500	BT3	1	85.1	87.0	.51	.66
10403	BT2	1	86.7	[illegible]	.63	.82
10402	BT2	1	90.6	91.2	1.06	1.16
10401	BT2	1	83.6	85.7	.42	.55
10400	BT2	1	86.2	[illegible]	.59	.77

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1065 USS STEIN

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.C.
50502	EN3	1	####	####	.00	0.00
50501	EN3	1	####	####	.00	0.00
50500	EN3	1	####	####	.00	0.00
50300	EN1	1	####	####	.00	0.00
30201	FA	1	####	####	.00	0.00
30200	FA	1	83.9	85.1	.43	.77
30100	FN	1	87.1	90.2	.67	1.03
20602	MMFN	1	93.8	96.4	1.70	2.43
20601	MMFN	1	90.9	93.5	1.13	1.62
20600	MMFN	1	88.8	91.4	.85	1.22
20505	MM3	1	90.9	93.5	1.13	1.62
20504	MM3	1	90.9	93.5	1.13	1.62
20503	MM3	1	85.9	88.5	.57	.81
20502	MM3	1	91.4	95.6	1.21	2.16
20501	MM3	1	87.3	91.5	.69	1.24
20500	MM3	1	80.9	83.5	.28	.41
20402	MM2	1	91.7	92.9	1.26	1.50
20401	MM2	1	93.6	97.8	1.64	2.94
20400	MM2	1	87.3	91.5	.69	1.24
20302	MM1	1	82.5	85.1	.35	.51
20301	MM1	1	94.8	95.7	1.95	2.19
20300	MM1	1	90.6	92.1	1.09	1.33
20200	MMC	1	50.0	50.0	.00	0.00
10701	ETFA	1	87.1	90.2	.67	1.03
10700	ETFA	1	87.1	90.2	.67	1.03
10602	ETFN	1	87.1	90.2	.67	1.03
10601	ETFN	1	77.1	80.2	.17	.26
10600	ETFN	1	90.0	93.1	1.00	1.54
10502	ET3	1	90.9	94.0	1.14	1.75
10501	ET3	1	77.1	80.2	.17	.26
10500	ET3	1	92.5	95.6	1.42	2.16
10400	ET2	1	87.1	90.2	.67	1.03
10300	ET1	1	87.1	90.2	.67	1.03
10200	ETC	1	86.6	89.7	.62	.95

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1084 USS CANDLESS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.O.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.O.
60202	LTJG	1	72.1	75.4	.08	.13
60201	LTJG	1	80.3	83.0	.26	.41
60200	LTJG	1	84.1	86.2	.44	.59
60100	LT	1	72.1	75.4	.08	.13
50501	EN3	1	94.8	96.1	1.95	3.08
50500	EN3	1	96.1	99.4	2.34	3.70
50300	EN1	1	99.1	102.4	3.52	5.55
40500	EM3	1	74.3	75.2	.11	.13
40400	EM2	1	90.9	93.9	1.13	1.73
40200	EMC	1	89.3	91.3	.90	1.20
30300	FR	1	74.2	77.5	.11	.15
30102	FN	1	72.[illegible]	7[illegible].4	.14	.17
30101	FN	1	85.3	88.8	.52	.82
30100	FN	1	80.3	83.2	.26	.39
20701	MMFA	1	88.5	92.5	.81	1.12
20603	MMFN	1	80.8	89.1	.04	.06
20602	MMFN	1	82.1	85.4	.33	.53
20601	MMFN	1	88.7	92.0	.84	1.32
20600	MMFN	1	80.0	87.1	.04	.06
20504	MM3	1	88.8	90.1	.64	1.01
20503	MM3	1	84.2	87.2	.45	.70
20502	MM3	1	80.[illegible]	89.1	.04	.06
20501	MM3	1	85.4	85.9	.53	.50
20500	MM3	1	88.1	[illegible]	.59	.79
20401	MM2	1	83.2	86.5	.39	.52
20400	MM2	1	69.2	72.5	.06	.09
10701	BTFA	1	85.2	88.4	.41	.61
10700	BTFA	1	87.4	90.3	.70	1.04
10606	BTFN	1	84.0	86.9	.43	.65
10605	BTFN	1	83.5	86.4	.41	.61
10604	BTFN	1	80.3	83.2	.26	.39
10603	BTFN	1	83.5	86.4	.41	.61
10602	BTFN	1	82.7	85.6	.36	.54
10601	BTFN	1	84.0	86.9	.43	.65
10600	BTFN	1	82.4	85.3	.35	.52
10501	BT3	1	79.5	82.4	.23	.35

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1084 USS CANDLESS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL W.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE W.C.
10500	BT3	1	83.5	86.4	.41	.61
10400	BT2	1	81.8	84.7	.32	.46
10300	BT1	1	83.5	86.4	.41	.61
10201	BTC	1	79.5	82.4	.23	.35
10200	BTC	1	74.5	77.4	.12	.17

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DB

FF-1090 USS AINSWORTH

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.C.
60100	LT	1	93.6	96.6	1.65	2.49
40601	EMFN	1	84.0	86.0	.43	.57
40600	EMFN	1	84.0	86.0	.43	.57
40500	EM3	1	84.0	86.0	.43	.57
20700	MMFA	1	78.4	81.5	.20	.31
20602	MMFA	1	73.4	76.5	.10	.15
20601	MMFN	1	84.0	86.0	.43	.57
20600	MMFN	1	89.0	91.0	.87	1.15
20502	MM3	1	93.0	97.8	1.52	2.93
20501	MM3	1	89.0	91.0	.87	1.15
20500	MM3	1	89.0	91.0	.87	1.15
20402	MM2	1	89.0	91.0	.87	1.15
20401	MM2	1	83.4	86.5	.40	.61
20400	MM2	1	89.0	91.0	.87	1.15
10703	ETFA	1	[illegible]	[illegible]	[illegible]	.64
10702	ETFA	1	83.8	87.4	.42	.69
10701	ETFA	1	85.6	89.2	.54	.89
10700	ETFA	1	79.7	83.3	.24	.40
10600	ETFN	1	83.8	87.4	.42	.69
10500	ET3	1	82.0	85.6	.33	.55
10400	ET2	1	83.8	87.4	.42	.69
10200	ETC	1	84.7	88.3	.48	.79

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1091 USS MILLER

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL W.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE W.C.
60200	LTJG	1	75.2	7[illegible].7	.13	.21
60100	LT	1	73.1	76.6	.10	.16
40300	EMI	1	[illegible]	[illegible]	.00	.00
20601	MMFN	1	89.0	91.9	.67	1.35
20600	MMFN	1	89.0	91.9	.67	1.30
20401	MM2	1	89.6	92.5	.94	1.41
20400	MM2	1	89.3	91.5	.90	1.22
20300	MM1	1	90.6	93.5	1.09	1.62
20200	MMC	1	91.1	94.0	1.16	1.73
10702	BTFA	1	83.8	92.3	.85	1.36
10701	BTFA	1	80.1	91.0	.77	1.25
10700	BTFA	1	81.0	84.5	.29	.47
10607	BTFN	1	89.9	93.4	.97	1.61
10606	BTFN	1	80.4	92.9	.80	1.30
10605	BTFN	1	89.7	93.2	.96	1.50
10604	BTFN	1	83.2	86.7	.51	.83
10603	BTFN	1	80.4	91.9	.80	1.30
10602	BTFN	1	82.7	92.2	.83	1.35
10601	BTFN	1	83.7	92.2	.83	1.35
10600	BTFN	1	84.2	87.7	.45	.73
10501	BT3	1	86.6	91.3	.64	1.04
10500	BT3	1	85.2	86.7	.51	.83
10402	BT2	1	87.5	92.0	.70	1.14
10401	BT2	1	89.7	93.2	.96	1.56
10400	BT2	1	89.7	93.2	.96	1.56
10301	BT1	1	87.5	92.0	.70	1.14
10300	BT1	1	86.8	87.1	.64	.67
10200	BTC	1	86.6	90.1	.62	1.01

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1097 USS MOINESTER

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.C.
40500	EM3	1	79.0	81.9	.22	.33
40400	EM2	1	84.5	87.0	.47	.67
40300	EM1	1	85.3	88.2	.52	.77
20702	MMFA	1	83.6	85.5	.41	.61
20701	MMFA	1	81.9	84.6	.33	.49
20700	MMFA	1	88.8	90.7	.82	1.10
20504	MM3	1	85.3	88.2	.52	.77
20503	MM3	1	79.0	81.9	.22	.33
20502	MM3	1	89.7	91.8	.96	1.29
20501	MM3	1	85.5	88.9	.53	.85
20500	MM3	1	83.8	88.7	.42	.63
20400	MM2	1	87.9	90.1	.75	1.01
20300	MM1	1	85.1	88.8	.58	.87
20200	MMC	1	85.8	87.7	.56	.72
10700	ETFA	1	95.0	99.5	1.99	3.71
10603	ETFN	1	90.4	94.9	1.06	1.97
10602	ETFN	1	95.8	100.3	2.23	4.15
10601	ETFN	1	93.5	97.5	1.62	2.84
10600	ETFN	1	89.0	92.8	.87	1.42
10503	ET3	1	95.8	100.3	2.23	4.15
10502	ET3	1	94.5	98.8	1.87	3.39
10501	ET3	1	95.0	99.5	1.99	3.71
10500	ET3	1	93.6	98.1	1.64	3.06
10401	ET2	1	90.4	94.9	1.06	1.97
10400	ET2	1	89.5	94.0	.94	1.75
10300	ET1	1	95.8	100.3	2.23	4.15
10200	ETC	1	95.8	100.3	2.23	4.15

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1094 USS PHARRIS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL R.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE R.C.
50300	EN1	1	****	****	.00	0.00
40700	EMFA	1	74.2	76.0	.11	.14
40501	EM3	1	****	****	.00	0.00
40500	EM3	1	74.7	75.6	.12	.14
40400	EM2	1	79.3	77.0	.23	.24
30100	EN	1	82.3	84.9	.35	.45
20602	MMFN	1	89.2	91.0	.89	1.15
20601	MMFN	1	89.0	92.5	.87	1.23
20600	MMFN	1	85.0	88.1	.54	.77
20507	MM3	1	89.2	91.0	.89	1.15
20506	MM3	1	87.3	89.9	.69	.95
20505	MM3	1	87.3	89.9	.69	.95
20504	MM3	1	89.2	91.0	.89	1.15
20503	MM3	1	86.4	88.7	.61	.85
20502	MM3	1	90.2	90.2	1.03	1.12
20501	MM3	1	72.3	74.9	.09	.12
20500	MM3	1	****	****	.00	0.00
20401	MM2	1	87.3	89.9	.69	.95
20400	MM2	1	89.2	91.0	.89	1.15
20300	MM1	1	87.3	89.9	.69	.95
10802	ETFR	1	90.1	92.6	1.01	1.47
10801	ETFR	1	90.1	92.6	1.01	1.47
10800	ETFR	1	90.1	92.6	1.01	1.47
10607	ETFN	1	90.1	92.6	1.01	1.47
10606	ETFN	1	90.1	92.6	1.01	1.47
10605	ETFN	1	90.1	92.6	1.01	1.47
10604	ETFN	1	90.1	92.6	1.01	1.47
10603	ETFN	1	89.9	92.5	.99	1.42
10602	ETFN	1	90.1	92.6	1.01	1.47
10601	ETFN	1	88.6	91.5	.82	1.22
10600	ETFN	1	89.7	92.3	.97	1.38
10503	ET3	1	90.1	92.6	1.01	1.47
10502	ET3	1	85.1	87.6	.51	.73
10501	ET3	1	90.1	92.5	1.01	1.47
10500	ET3	1	90.1	92.6	1.01	1.47
10401	ET2	1	90.1	92.6	1.01	1.47

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1094 USS PHARRIS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.C.
10400	ET2	1	89.6	92.4	.95	1.40
10301	ET1	1	90.1	92.8	1.01	1.47
10300	ET1	1	71.5	[illegible]	.06	.09

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1085 USS BEARY

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL R.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE R.C.
60301	ENS	1	91.9	95.1	1.31	2.03
60300	ENS	1	88.7	89.4	.85	.92
60200	LTJG	1	74.0	77.0	.12	.16
60100	LT	1	86.1	89.1	.58	.89
50600	ENFN	1	97.8	100.9	2.94	4.56
50500	EN3	1	100.2	103.3	4.22	6.22
50300	EN1	1	98.5	101.7	3.27	5.06
40600	EMFN	1	95.0	100.1	2.01	4.05
40500	EM3	1	88.2	91.1	.82	1.16
40400	EM2	1	89.5	93.1	.94	1.55
30200	FA	1	95.9	100.1	2.21	4.05
30100	FN	1	[illegible]	92.4	.84	1.39
20901	MM	1	89.4	91.5	.92	1.23
20900	MM	1	88.4	89.2	.81	.90
21700	MMFA	1	91.5	93.8	1.23	1.70
20602	MMFN	1	81.4	84.2	.30	.45
20601	MMFN	1	91.4	94.2	1.21	1.80
20600	MMFN	1	88.1	93.7	.77	1.67
20503	MM3	1	89.4	91.6	.92	1.25
20502	MM3	1	88.4	89.2	.81	.90
20501	MM3	1	93.5	95.4	1.63	2.11
20500	MM3	1	94.4	96.0	1.84	2.30
20402	MM2	1	99.9	103.0	3.92	6.06
20401	MM2	1	83.3	86.3	.40	.60
20400	MM2	1	95.5	97.9	2.15	2.98
20200	MMC	1	93.6	95.3	1.64	2.10
10901	ET	1	90.8	94.5	1.12	1.86
10900	ET	1	90.8	94.5	1.12	1.86
10700	ETFA	1	90.8	94.5	1.12	1.86
10600	ETFA	1	87.9	91.5	.75	1.24
10505	ET3	1	97.7	101.3	2.90	4.79
10504	ET3	1	92.9	96.5	1.50	2.47
10503	ET3	1	90.8	94.5	1.12	1.86
10502	ET3	1	86.4	89.2	.61	.90
10501	ET3	1	90.8	94.5	1.12	1.86
10500	ET3	1	95.0	98.7	2.01	3.32

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1085 USS BEARY

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.C.
10301	ET1	1	87.2	95.7	.68	1.11
10300	ET1	1	92.2	95.7	1.36	2.21

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1092 USS HART

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.C.
60200	LTJG	1	79.3	81.0	.23	.29
21000	MMCS	1	89.2	92.5	.69	1.42
20800	MMFN	1	88.9	91.5	.66	1.23
20700	MMFA	1	95.1	96.5	2.02	3.20
20602	MMFN	1	83.0	85.2	.38	.51
20601	MMFN	1	89.7	91.5	.90	1.24
20600	MMFN	1	91.5	91.9	1.23	1.29
20504	MM3	1	93.2	93.0	1.05	1.52
20503	MM3	1	89.1	91.3	.88	1.19
20502	MM3	1	92.5	95.9	1.42	2.26
20501	MM3	1	92.5	95.9	1.42	2.25
20500	MM3	1	83.5	88.9	.40	.65
10605	BTFN	1	83.5	85.7	.41	.55
10604	BTFN	1	83.5	85.7	.41	.55
10603	BTFN	1	71.6	74.7	.07	.09
10602	BTFN	1	88.5	90.7	.62	1.10
10601	BTFN	1	85.1	87.3	.51	.69
10600	BTFN	1	73.5	71.9	.05	.06
10505	BT3	1	76.5	80.7	.20	.27
10504	BT3	1	80.5	85.5	.61	.82
10503	BT3	1	85.6	87.7	.54	.73
10502	BT3	1	89.0	91.0	.95	1.25
10501	BT3	1	84.6	88.8	.48	.64
10500	BT3	1	86.0	88.2	.58	.76
10401	BT2	1	91.5	93.6	1.22	1.64
10400	BT2	1	75.6	77.7	.14	.15
10300	BT1	1	83.5	85.7	.41	.55
10100	BTCM	1	84.6	88.8	.48	.64

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1081 USS AYLWIN

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL W.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE W.C.
60301	ENS	1	90.2	93.0	1.03	1.52
60300	ENS	1	84.4	85.2	.40	.51
60200	LTJG	1	85.8	87.2	.56	.66
60100	LT	1	90.9	93.6	1.13	1.69
50600	ENFN	1	88.8	91.9	.83	1.30
50500	EN3	1	79.3	84.6	.23	.47
40300	EM1	1	88.9	91.0	.85	1.15
20605	MMFN	1	87.7	90.9	.73	1.14
20604	MMFN	1	92.1	95.0	1.34	2.00
20603	MMFN	1	86.3	89.5	.60	.94
20602	MMFN	1	82.3	85.5	.34	.54
20601	MMFN	1	88.9	92.1	.85	1.34
20600	MMFN	1	88.7	92.0	.83	1.3[illegible]
20506	MM3	1	87.3	90.5	.66	1.07
20505	MM3	1	87.9	89.8	.75	.97
20504	MM3	1	88.9	92.1	.85	1.34
20503	MM3	1	83.9	87.1	.43	.67
20502	MM3	1	87.3	90.5	.66	1.07
20501	MM3	1	83.9	87.1	.43	.67
20500	MM3	1	88.9	92.1	.85	1.34
20404	MM2	1	87.3	90.5	.66	1.07
20403	MM2	1	83.1	85.4	.39	.53
20402	MM2	1	88.1	91.4	.77	1.21
20401	MM2	1	80.2	83.4	.26	.40
20400	MM2	1	85.6	88.5	.62	.81
20300	MM1	1	90.3	92.2	1.04	1.35
10601	BTFN	1	91.4	92.0	1.22	1.32
10600	BTFN	1	92.5	95.4	1.41	2.11
10505	BT3	1	90.9	93.6	1.13	1.69
10504	BT3	1	89.1	92.0	.88	1.32
10503	BT3	1	91.7	94.6	1.27	1.90
10502	BT3	1	91.7	94.6	1.27	1.90
10501	BT3	1	89.1	92.0	.88	1.32
10500	BT3	1	90.9	93.6	1.13	1.69
10400	BT2	1	93.8	96.7	1.69	2.53
10300	BT1	1	89.9	92.8	.99	1.48

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1097 USS MOINESTER

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL W.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE W.C.
10605	ETFN	1	89.0	93.1	.88	1.55
10604	ETFN	1	84.0	88.1	.44	.77
10603	ETFN	1	90.1	94.3	1.02	1.81
10602	ETFN	1	90.6	94.8	1.09	1.93
10601	ETFN	1	90.1	94.3	1.02	1.81
10600	ETFN	1	89.0	93.1	.88	1.55
10507	ET3	1	87.7	92.0	.73	1.29
10506	ET3	1	92.0	95.1	1.31	2.32
10505	ET3	1	89.4	93.6	.92	1.61
10504	ET3	1	81.1	85.2	.29	.52
10503	ET3	1	91.4	94.2	1.21	1.79
10502	ET3	1	91.6	94.8	1.28	1.95
10501	ET3	1	91.5	94.8	1.27	1.95
10500	ET3	1	87.7	92.0	.73	1.29
10403	ET2	1	89.0	93.1	.88	1.55
10402	ET2	1	94.0	98.1	1.75	3.09
10401	ET2	1	91.5	95.7	1.24	2.19
10400	ET2	1	89.0	93.1	.88	1.55
10200	ETC	1	70.0	72.1	.00	.02

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1075 USS TRIPPE

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.C.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.C.
30300	FR	1	80.0	83.3	.27	.40
20700	MMFA	1	85.0	88.3	.54	.79
20602	MMFN	1	85.0	88.3	.54	.79
20601	MMFN	1	89.9	91.7	.98	1.26
20600	MMFN	1	89.9	91.7	.98	1.26
20500	MM3	1	91.2	[illegible]	1.18	1.52
20400	MM2	1	83.3	85.1	.39	.51
10700	ETFA	1	90.5	93.0	1.07	1.51
10601	ETFN	1	90.5	93.0	1.07	1.51
10600	ETFN	1	87.5	90.0	.71	1.01
10501	ET3	1	90.5	93.0	1.07	1.51
10500	ET3	1	87.5	90.0	.71	1.01
10402	ET2	1	90.5	93.0	1.07	1.51
10401	ET2	1	87.5	90.0	.71	1.01
10400	ET2	1	85.5	88.0	.53	.75
10300	ET1	1	85.5	88.0	.53	.75

APPENDIX L

Grade Average Noise Exposure Results for Each Ship Using General Area Average Noise Levels

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1083 USS COOK

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
203	MM1	2	68.2	3.0	.65	.42
104	ET2	4	66.5	2.8	.66	.28
107	ETFA	3	66.2	3.1	.63	.30
105	ET3	1	65.1	0.0	.51	0.00
205	MM3	2	64.5	2.8	.50	.18
106	ETEN	3	63.2	2.7	.41	.14
207	MMFA	1	62.9	0.0	.38	0.00
206	MMFN	2	62.0	3.9	.35	.16
204	MM2	2	60.2	5.6	.30	.21
602	LTJG	1	72.2	0.0	.06	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1065 USS STEIN

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
206	MMFN	3	91.2	2.5	1.23	.43
204	MM2	3	90.9	3.2	1.20	.42
203	MM1	3	89.3	6.3	1.13	.80
105	BT3	3	88.8	8.5	.91	.60
205	MM3	6	87.9	4.1	.84	.38
103	BT1	1	87.1	0.0	.87	0.00
104	BT2	1	87.1	0.0	.87	0.00
107	BTFA	2	87.1	0.0	.87	0.00
301	EN	1	87.1	0.0	.87	0.00
102	BTC	1	86.6	0.0	.82	0.00
106	BTFN	3	84.7	8.8	.81	.42
302	EA	2	83.9	0.0	.22	.31
202	MMC	1	*****	*****	.00	0.00
503	EN1	1	*****	*****	.00	0.00
505	EN3	1	*****	*****	.00	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1084 USS CANDLESS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
503	EN1	1	99.1	0.0	3.52	0.00
505	EN3	2	95.5	.9	2.15	.23
404	EM2	1	91.9	0.0	1.13	0.00
402	EMC	1	89.3	0.0	.90	0.00
207	MMFA	1	86.5	0.0	.61	0.00
206	MMFN	4	86.1	2.6	.61	.21
205	MM3	5	85.9	1.1	.57	.06
107	ETFA	2	85.4	2.7	.55	.20
103	ET1	1	83.5	0.0	.41	0.00
106	ETFN	7	82.9	1.3	.38	.06
104	ET2	1	81.6	0.0	.32	0.00
105	ET3	2	81.5	.9	.32	.12
301	FN	3	77.5	7.4	.27	.24
602	LTJG	3	76.5	0.1	.26	.17
214	MM2	2	76.2	4.9	.22	.24
102	ETC	2	77.0	3.5	.17	.06
405	EM3	1	74.3	0.0	.11	0.00
303	FS	1	74.2	0.0	.11	0.00
601	LT	1	72.1	0.0	.06	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1090 USS AINSWORTH

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
601	ET	1	93.5	0.0	[illegible]	0.00
205	MM3	3	[illegible]	[illegible]	[illegible]	[illegible]
204	MM2	3	[illegible]	[illegible]	.71	.27
102	ETC	1	84.7	0.0	.48	0.00
206	MMFN	3	82.1	7.9	.47	[illegible]
405	EM3	1	84.0	0.0	.43	0.00
406	EMFN	2	[illegible]	0.0	.43	0.00
107	ETFA	4	[illegible]	[illegible]	.43	.14
104	ET2	1	[illegible]	0.0	.42	0.00
106	ETFN	1	83.3	0.0	.42	0.00
105	ET3	1	[illegible]	0.0	.33	0.00
207	MMFA	1	75.4	[illegible]	.26	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1091 USS MILLER

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
202	MMC	1	91.1	0.0	1.16	0.00
203	MM1	1	90.6	0.0	1.09	0.00
204	MM2	2	89.4	.2	.92	.03
104	ET2	3	89.0	1.3	.87	.15
206	MMFN	2	89.0	0.0	.87	0.00
106	ETFN	6	87.9	2.1	.77	.19
103	ET1	2	87.1	.5	.67	.05
107	ETFA	3	86.0	4.3	.63	.30
102	ETC	1	86.6	0.0	.62	0.00
105	ET3	2	86.0	1.1	.58	.09
602	LTJG	1	75.2	0.0	.13	0.00
201	LT	1	73.1	0.0	.10	0.00
403	EM1	1	*****	*****	.00	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1097 USS MOINESTER

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOS. MEAN	DAILY NOISE DOS. S.D.
102	ETC	1	95.0	0.0	2.23	0.00
103	ET1	1	95.8	0.0	2.23	0.00
107	ETFA	1	[illegible]	[illegible]	1.99	0.00
105	ET3	4	94.7	.9	1.93	.24
106	ETRN	4	92.2	3.1	1.44	.61
104	ET2	2	90.0	.6	1.00	.02
204	MM2	1	87.4	0.0	.75	0.00
202	MMC	1	85.8	0.0	.56	0.00
205	MM3	5	84.0	1.0	.53	.27
207	MMFA	3	84.7	3.5	.52	.20
403	EM1	1	85.3	0.0	.52	0.00
404	EM2	1	84.5	0.0	.47	0.00
203	MM1	1	83.1	0.0	.30	0.00
405	EM3	1	79.0	0.0	.22	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1094 USS PHARRIS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
106	ETFA	3	90.1	0.0	1.01	0.00
104	ET2	2	90.0	.2	1.00	.03
102	ETEA	6	89.8	.5	.93	.07
105	ET3	4	88.8	2.5	.89	.25
204	MM2	2	88.2	1.3	.79	.14
206	MMFA	3	87.9	2.0	.77	.19
203	MM1	1	87.3	0.0	.69	0.00
205	MM3	8	86.0	6.2	.61	.36
103	ET1	2	80.6	13.1	.55	.22
301	FN	1	82.3	0.0	.55	0.00
404	EM2	1	79.3	0.0	.23	0.00
407	EMFA	1	74.2	0.0	.11	0.00
405	EM3	2	74.7	0.0	.08	.00
503	EN1	1	*****	*****	.00	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1085 USS BEARY

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
505	EN3	1	100.2	0.0	4.12	0.00
503	EN1	1	98.5	0.0	3.27	0.00
506	ENFN	1	97.8	0.0	2.94	0.00
302	FA	1	96.9	0.0	2.61	0.00
406	EMFN	1	96.9	0.0	2.61	0.00
204	MM2	3	93.0	0.5	2.16	1.76
202	MMC	1	93.6	0.0	1.64	0.00
105	ET3	6	92.3	3.9	1.54	.81
205	MM3	4	90.9	3.7	1.25	.55
207	MMFA	1	91.5	0.0	1.23	0.00
107	ETFA	1	90.8	0.0	1.12	0.00
109	ET	2	90.3	[illegible]	1.12	[illegible]
603	EN3	2	90.3	0.3	1.07	.32
103	ET1	2	89.7	0.5	1.02	.45
404	EM2	1	89.5	0.0	.94	0.00
301	FN	1	88.8	0.0	.84	0.00
405	EM3	1	88.6	0.0	.82	0.00
209	MM	2	87.9	1.1	.76	.22
206	MMFN	3	87.0	5.1	.76	.45
106	ETFN	1	87.9	0.0	.75	0.00
601	ET	1	86.1	0.0	.58	0.00
602	LTJG	1	74.6	0.0	.12	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1092 USS HART

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
207	MMFA	1	95.1	0.0	2.02	0.00
205	MM3	5	89.6	3.7	1.03	.42
~~210~~	~~MMCS~~	~~1~~	~~89.2~~	~~0.0~~	~~.89~~	~~0.00~~
208	MMFR	1	88.9	0.0	.80	0.00
206	MMFN	3	88.1	4.5	.86	.44
~~104~~	~~ET2~~	~~2~~	~~83.5~~	~~1.2~~	~~.66~~	~~.77~~
105	ET3	6	85.2	3.7	.56	.24
101	ETCM	1	84.6	0.0	.45	0.00
~~103~~	~~ET1~~	~~1~~	~~83.5~~	~~0.0~~	~~.41~~	~~0.00~~
106	ETFN	6	80.0	8.3	.38	.29
602	LTJG	1	79.3	0.0	.23	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1081 USS AYLWIN

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
104	ET2	1	93.8	0.0	1.69	0.00
106	ETFN	2	92.0	.7	1.32	.15
601	LI	1	90.9	0.0	1.13	0.00
105	ET3	6	90.6	1.2	1.09	.15
203	MM1	1	90.3	0.0	1.04	0.00
103	ET1	1	89.9	0.0	.99	0.00
403	EM1	1	88.9	0.0	.85	0.00
206	MMFN	6	87.7	3.3	.78	.33
603	ENS	2	87.3	4.1	.75	.43
205	MM3	7	86.8	2.1	.67	.26
506	ENFN	1	86.0	0.0	.63	0.00
602	ETJG	1	[illegible]	0.0	.56	0.00
204	MM2	5	85.1	3.3	.54	.21
505	EN3	1	79.3	0.0	.23	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1097 USS MOINESTER

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOS. MEAN	DAILY NOISE DOS. S.D.
104	BT2	4	90.9	2.4	1.16	.41
202	MMC	1	90.1	0.0	1.01	0.00
105	BT3	8	[illegible]	3.7	.67	.37
203	MM1	1	88.8	0.0	.85	0.00
106	BTFN	7	88.9	5.6	.78	.30
301	EN	3	86.0	1.7	.52	.13
205	MM3	7	83.3	4.2	.45	.24
207	MMFA	4	83.3	5.0	.45	.21
204	MM2	2	82.8	1.5	.37	.08
603	ENS	1	82.7	0.0	.37	0.00
108	BTFR	2	79.6	6.9	.34	.34
206	MMFR	2	[illegible]	3.7	.31	.12
503	EN1	1	75.9	0.0	.14	0.00
107	BTFA	2	72.9	2.0	.10	.03
102	BTC	1	[illegible]	0.0	.06	0.00
504	EN2	1	67.5	0.0	.04	0.00
601	LT	1	65.6	0.0	.03	0.00
604	LCDR	1	[illegible]	0.0	.02	0.00

PERSONNEL NOISE EXPOSURE AND IMPACT AVERAGES

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

FF-1075 USS TRIPPE

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL S.D.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE S.D.
205	MM3	1	91.2	.0	1.15	0.00
107	GTF2	1	90.5	0.0	1.07	0.00
105	ET3	2	89.0	2.1	.69	.23
106	GTFN	2	89.0	2.1	.69	.23
206	MMFN	3	86.4	2.5	.64	.25
104	ET2	3	87.3	2.5	.77	.27
207	GMT2	1	85.0	0.0	.54	0.00
103	GT1	1	85.5	0.0	.53	0.00
204	MM2	1	83.3	0.0	.39	0.00
303	FN	1	80.0	0.0	.27	0.00

APPENDIX M

Individual Noise Exposure Results for All 12 Ships Using General Area Average Over All 12 Ships For the Noise Level Data

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DB

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.L.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.L.
60400	LCDR	1	64.1	69.8	.03	.06
60304	ENS	1	85.3	91.1	.52	1.17
60303	ENS	1	85.1	88.2	.51	.59
60302	ENS	1	86.9	93.7	.65	1.65
60301	ENS	1	86.0	88.5	.52	.82
60300	ENS	1	86.1	89.3	.56	.91
60207	LTJG	1	74.5	79.5	.12	.23
60206	LTJG	1	74.3	77.8	.11	.16
60205	LTJG	1	75.3	81.1	.13	.29
60204	LTJG	1	83.9	88.2	.43	.59
60203	LTJG	1	79.5	84.5	.23	.47
60202	LTJG	1	71.5	75.8	.06	.14
60201	LTJG	1	81.3	83.2	.30	.39
60200	LTJG	1	87.5	[illegible]	.71	1.03
60105	LT	1	74.3	77.8	.11	.16
60104	LT	1	90.9	94.1	1.13	1.70
60103	LT	1	77.4	82.4	.16	.33
60102	LT	1	83.0	87.1	.38	.67
60101	LT	1	89.5	94.5	.93	1.87
60100	LT	1	64.1	66.7	.03	.04
50601	ENFN	1	91.2	97.0	1.17	2.03
50600	ENFN	1	97.0	103.4	2.07	6.42
50506	EN3	1	93.2	99.0	1.57	3.50
50505	EN3	1	95.3	101.1	2.09	4.07
50504	EN3	1	98.5	104.6	3.39	7.59
50503	EN3	1	89.8	93.7	.92	2.19
50502	EN3	1	91.2	97.0	1.17	2.03
50501	EN3	1	93.9	99.4	1.72	3.66
50500	EN3	1	90.3	96.1	1.04	2.34
50400	EN2	1	81.9	87.7	.33	.73
50304	EN1	1	93.2	99.0	1.57	3.50
50303	EN1	1	94.1	99.9	1.76	3.94
50302	EN1	1	95.3	101.1	2.09	4.07
50301	EN1	1	91.9	97.7	1.31	2.92
50300	EN1	1	90.3	96.1	1.04	2.34
40700	EMFA	1	74.1	76.7	.11	.16

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL MAX.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE MAX.
40602	EMFN	1	84.1	88.7	.44	.63
40601	EMFN	1	84.1	88.7	.44	.63
40600	EMFN	1	90.3	96.1	1.04	2.34
40505	EM3	1	76.8	78.0	.16	.19
40504	EM3	1	84.1	88.7	.44	.63
40503	EM3	1	81.4	84.9	.30	.49
40502	EM3	1	70.3	76.1	.07	.15
40501	EM3	1	77.9	80.5	.19	.27
40500	EM3	1	84.9	88.9	.49	.85
40403	EM2	1	88.7	91.8	.84	1.28
40402	EM2	1	79.5	84.5	.23	.47
40401	EM2	1	82.0	85.3	.36	.52
40400	EM2	1	85.1	91.1	.58	1.17
40302	EM1	1	80.3	86.1	.26	.58
40301	EM1	1	87.7	91.1	.72	1.17
40300	EM1	1	95.1	99.9	2.02	3.96
40200	EML	1	88.9	91.2	.85	1.18
30301	FR	1	76.4	79.9	.15	.25
30300	FR	1	81.4	84.9	.30	.49
30202	FA	1	95.3	101.1	2.19	4.67
30201	FA	1	83.0	88.5	.38	.81
30200	FA	1	90.3	96.1	1.04	2.34
30108	FN	1	85.5	94.5	.53	1.87
30107	FN	1	69.3	72.0	.00	.09
30106	FN	1	80.3	86.1	.26	.58
30105	FN	1	88.1	95.7	.82	2.11
30104	FN	1	81.4	84.9	.30	.49
30103	FN	1	85.4	90.4	.53	1.05
30102	FN	1	82.4	87.4	.35	.70
30101	FN	1	87.5	89.6	.71	.94
30100	FN	1	87.5	89.6	.71	.94
21000	MMCS	1	82.4	87.7	.36	.73
20901	MM	1	87.1	89.5	.67	.95
20900	MM	1	84.3	87.8	.46	.74
20800	MMFA	1	89.2	90.6	.96	1.09
20712	MMFA	1	80.1	85.0	.33	.47

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL MAX.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE MAX.
20711	MMFA	1	90.4	92.9	1.06	1.50
20710	MMFA	1	81.4	84.5	.30	.47
20709	MMFA	1	86.0	89.4	.57	.92
20708	MMFA	1	84.3	87.8	.46	.74
20707	MMFA	1	87.1	89.6	.67	.95
20706	MMFA	1	87.1	91.7	.69	1.27
20705	MMFA	1	93.0	96.5	1.52	2.46
20704	MMFA	1	87.3	90.7	.68	1.11
20703	MMFA	1	77.3	80.7	.17	.28
20702	MMFA	1	87.3	90.7	.68	1.11
20701	MMFA	1	87.3	90.7	.68	1.11
20700	MMFA	1	86.4	89.9	.61	.98
20639	MMFN	1	79.3	82.8	.23	.37
20638	MMFN	1	84.9	86.3	.49	.60
20637	MMFN	1	92.1	94.6	1.33	1.90
20636	MMFN	1	87.1	91.7	.69	1.27
20635	MMFN	1	87.1	89.6	.67	.95
20634	MMFN	1	88.7	91.2	.83	1.19
20633	MMFN	1	84.3	87.8	.46	.74
20632	MMFN	1	91.0	94.4	1.14	1.84
20631	MMFN	1	88.7	91.2	.83	1.19
20630	MMFN	1	76.4	79.9	.15	.25
20629	MMFN	1	84.1	86.7	.44	.63
20628	MMFN	1	87.1	91.7	.69	1.27
20627	MMFN	1	89.3	92.8	.91	1.47
20626	MMFN	1	89.3	92.8	.91	1.47
20625	MMFN	1	87.1	91.7	.69	1.27
20624	MMFN	1	88.0	91.5	.76	1.23
20623	MMFN	1	84.8	88.1	.48	.77
20622	MMFN	1	79.3	82.8	.23	.37
20621	MMFN	1	89.3	92.8	.91	1.47
20620	MMFN	1	85.8	88.3	.56	.79
20619	MMFN	1	87.1	89.6	.67	.95
20618	MMFN	1	91.5	93.4	1.23	1.61
20617	MMFN	1	95.3	97.7	2.08	2.93
20616	MMFN	1	86.9	90.3	.65	1.04

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL R.L.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE R.L.
20615	MMFN	1	90.7	95.0	1.11	2.22
20614	MMFN	1	85.5	88.9	.53	.66
20613	MMFN	1	81.4	84.9	.30	.49
20612	MMFN	1	88.0	91.5	.70	1.23
20611	MMFN	1	89.1	91.7	.69	1.27
20610	MMFN	1	79.3	82.0	.23	.37
20609	MMFN	1	84.1	88.7	.44	.63
20608	MMFN	1	84.1	87.8	.48	.74
20607	MMFN	1	76.0	81.5	.19	.31
20606	MMFN	1	70.3	70.[illegible]	.07	.15
20605	MMFN	1	80.1	82.4	.38	.53
20604	MMFN	1	82.1	84.8	.35	.47
20603	MMFN	1	84.1	88.7	.44	.63
20602	MMFN	1	86.4	89.9	.61	.98
20601	MMFN	1	90.8	93.3	1.11	1.58
20600	MMFN	1	90.8	93.3	1.11	1.58
20552	MM3	1	82.1	84.8	.35	.47
20551	MM3	1	85.8	88.3	.56	.79
20550	MM3	1	89.1	91.7	.69	1.27
20549	MM3	1	89.1	91.7	.69	1.27
20548	MM3	1	84.1	88.7	.44	.63
20547	MM3	1	90.5	93.9	1.00	1.72
20546	MM3	1	86.4	89.9	.61	.98
20545	MM3	1	79.1	81.7	.22	.32
20544	MM3	1	89.0	92.5	.87	1.41
20543	MM3	1	86.4	89.9	.61	.98
20542	MM3	1	88.7	91.2	.83	1.19
20541	MM3	1	87.6	88.1	.72	.77
20540	MM3	1	88.0	91.5	.70	1.07
20539	MM3	1	82.7	91.4	.37	1.22
20538	MM3	1	89.1	91.7	.69	1.27
20537	MM3	1	89.1	91.7	.69	1.27
20536	MM3	1	87.7	91.1	.72	1.17
20535	MM3	1	81.4	84.9	.30	.49
20534	MM3	1	88.2	91.7	.78	1.11
20533	MM3	1	85.6	87.0	.54	.66

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL MAX.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE MAX.
20532	MM3	1	86.2	89.6	.59	.95
20531	MM3	1	89.1	91.7	.69	1.27
20530	MM3	1	86.4	89.9	.61	.95
20529	MM3	1	86.4	89.9	.61	.96
20528	MM3	1	89.1	91.7	.69	1.27
20527	MM3	1	85.5	88.9	.53	.80
20526	MM3	1	87.5	90.0	.44	1.05
20525	MM3	1	80.8	[illegible]	.27	.31
20524	MM3	1	95.3	101.1	2.09	4.07
20523	MM3	1	87.1	89.0	.67	.93
20522	MM3	1	84.3	87.3	.46	.74
20521	MM3	1	91.3	95.3	1.19	1.57
20520	MM3	1	92.1	94.6	1.33	1.90
20519	MM3	1	90.0	91.1	1.00	1.16
20518	MM3	1	93.2	95.7	1.55	2.22
20517	MM3	1	90.5	93.9	1.00	1.72
20516	MM3	1	93.5	93.9	1.56	1.72
20515	MM3	1	81.4	84.9	.30	.49
20514	MM3	1	86.4	89.9	.61	.98
20513	MM3	1	83.4	90.9	.40	1.13
20512	MM3	1	88.0	91.5	.76	1.23
20511	MM3	1	83.0	86.5	.38	.61
20510	MM3	1	86.4	89.9	.61	.95
20509	MM3	1	83.0	86.5	.38	.61
20508	MM3	1	88.0	91.5	.76	1.23
20507	MM3	1	88.7	91.2	.63	1.19
20506	MM3	1	81.4	84.9	.30	.49
20505	MM3	1	86.4	89.9	.61	.98
20504	MM3	1	85.5	88.3	.50	.79
20503	MM3	1	82.0	84.4	.29	.48
20502	MM3	1	87.5	90.2	.72	1.03
20501	MM3	1	79.3	[illegible]	.43	.37
20500	MM2	1	92.1	94.6	1.33	1.90
20425	MM2	1	83.8	85.7	.41	.55
20424	MM2	1	76.4	79.5	.15	.25
20423	MM2	1	90.4	92.8	1.05	1.29

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.E.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.E.
20422	MM2	1	92.7	95.1	1.45	2.33
20421	MM2	1	88.4	89.9	.81	.96
20420	MM2	1	85.5	86.9	.53	.66
20419	MM2	1	71.4	74.9	.06	.12
20418	MM2	1	89.1	91.7	.89	1.27
20417	MM2	1	88.4	89.9	.81	.96
20416	MM2	1	89.1	91.7	.89	1.27
20415	MM2	1	89.9	93.4	.99	1.65
20414	MM2	1	92.1	94.6	1.33	1.90
20413	MM2	1	88.4	89.6	.81	.87
20412	MM2	1	88.4	89.9	.81	.96
20411	MM2	1	89.1	91.7	.89	1.27
20410	MM2	1	93.2	94.6	1.57	3.53
20409	MM2	1	81.4	84.9	.31	.49
20408	MM2	1	93.2	95.7	1.55	2.22
20407	MM2	1	88.4	89.9	.81	.96
20406	MM2	1	82.3	84.1	.34	.53
20405	MM2	1	87.3	90.7	.68	1.11
20404	MM2	1	79.3	82.0	.23	.37
20403	MM2	1	87.1	89.8	.67	.95
20402	MM2	1	84.1	86.7	.44	.65
20401	MM2	1	82.1	84.6	.33	.47
20400	MM2	1	84.1	86.7	.44	.65
20309	MM1	1	90.0	92.6	1.00	1.42
20308	MM1	1	86.2	88.1	.59	.77
20307	MM1	1	80.5	83.3	.25	.40
20306	MM1	1	93.7	94.4	1.66	1.85
20305	MM1	1	89.2	92.6	.90	1.09
20304	MM1	1	91.0	94.4	1.14	1.84
20303	MM1	1	85.5	86.9	.53	.66
20302	MM1	1	88.4	89.9	.81	.96
20301	MM1	1	92.6	93.3	1.11	1.58
20300	MM1	1	89.1	91.7	.89	1.27
20204	MMC	1	80.3	82.2	.26	.36
20203	MMC	1	91.4	94.5	1.22	1.97
20202	MMC	1	85.0	87.2	.50	.67

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL MAX.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE MAX.
20201	MMC	1	89.1	92.2	.88	1.35
20200	MMC	1	92.8	95.4	1.47	2.12
10901	ET	1	87.4	92.4	.70	1.40
10900	ET	1	87.4	92.4	.70	1.40
10804	ETFA	1	92.4	97.4	1.40	2.81
10803	ETFR	1	92.4	97.4	1.40	2.81
10802	ETFR	1	92.4	97.4	1.40	2.81
10801	ETFR	1	75.7	81.4	.14	.30
10800	ETFR	1	84.5	89.5	.47	.94
10718	ETFA	1	92.1	97.1	1.34	2.69
10717	ETFA	1	87.4	92.4	.70	1.40
10716	ETFA	1	85.1	91.1	.53	1.27
10715	ETFA	1	89.5	94.5	.93	1.87
10714	ETFA	1	89.5	94.5	.93	1.87
10713	ETFA	1	88.5	93.0	.82	1.64
10712	ETFA	1	92.4	97.4	1.40	2.81
10711	ETFA	1	89.9	95.0	.99	1.99
10710	ETFA	1	88.5	93.0	.82	1.64
10709	ETFA	1	90.4	95.4	1.05	2.11
10708	ETFA	1	84.5	89.5	.47	.94
10707	ETFA	1	93.1	98.2	1.55	3.10
10706	ETFA	1	92.4	97.4	1.40	2.81
10705	ETFA	1	85.4	90.4	.53	1.05
10704	ETFA	1	89.9	95.0	.99	1.99
10703	ETFA	1	87.4	92.4	.70	1.40
10702	ETFA	1	69.5	74.5	.06	.12
10701	ETFA	1	77.1	82.7	.17	.30
10700	ETFA	1	92.4	97.4	1.40	2.81
10651	ETFN	1	82.4	87.4	.35	.70
10650	ETFN	1	87.4	92.4	.70	1.40
10649	ETFN	1	88.8	91.0	.84	[illegible]
10648	ETFN	1	89.5	94.5	.93	1.87
10647	ETFN	1	79.5	84.5	.23	.47
10646	ETFN	1	92.4	97.4	1.40	[illegible]
10645	ETFN	1	[illegible]	94.1	.82	[illegible]
10644	ETFN	1	[illegible]	93.0	.82	[illegible]

AD-A115 272 BOLT BERANEK AND NEWMAN INC CANOGA PARK CA F/G 6/19
DEVELOPMENT AND VALIDATION OF SHIPBOARD NOISE EXPOSURE DATA ACQ--ETC(U)
NOV 81 B A KUGLER, C H HANSEN, A G PIERSOL N00014-78-C-0408
UNCLASSIFIED BBN-4735 NL

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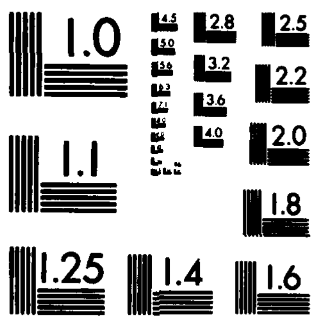

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL MAX.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE MAX.
10643	ETFN	1	86.4	90.9	.61	1.14
10642	ETFN	1	88.5	93.5	.82	1.64
10641	ETFN	1	87.7	92.7	.73	1.46
10640	ETFN	1	89.0	94.1	.86	1.75
10639	ETFN	1	87.4	92.4	.70	1.40
10638	ETFN	1	88.5	93.5	.82	1.64
10637	ETFN	1	94.3	99.3	1.81	3.63
10636	ETFN	1	92.7	97.7	1.46	2.92
10635	ETFN	1	94.0	99.1	1.75	3.51
10634	ETFN	1	91.0	95.3	1.16	2.09
10633	ETFN	1	92.7	97.7	1.46	2.92
10632	ETFN	1	93.0	98.0	1.52	3.04
10631	ETFN	1	93.0	98.0	1.52	3.04
10630	ETFN	1	88.5	93.5	.82	1.64
10629	ETFN	1	85.4	90.4	.53	1.05
10628	ETFN	1	90.7	95.8	1.11	2.22
10627	ETFN	1	89.1	93.3	.88	1.56
10626	ETFN	1	84.5	88.7	.49	.84
10625	ETFN	1	92.4	97.4	1.40	2.81
10624	ETFN	1	92.4	97.4	1.40	2.81
10623	ETFN	1	92.4	97.4	1.40	2.81
10622	ETFN	1	92.4	97.4	1.40	2.81
10621	ETFN	1	92.3	97.2	1.37	2.72
10620	ETFN	1	92.4	97.4	1.40	2.81
10619	ETFN	1	91.0	95.3	1.16	2.09
10618	ETFN	1	92.1	97.0	1.34	2.63
10617	ETFN	1	84.5	89.5	.47	.94
10616	ETFN	1	87.4	92.4	.70	1.40
10615	ETFN	1	87.4	92.4	.70	1.40
10614	ETFN	1	74.5	79.5	.12	.23
10613	ETFN	1	92.4	97.4	1.40	2.81
10612	ETFN	1	89.0	94.1	.86	1.75
10611	ETFN	1	80.4	89.9	.04	.06
10610	ETFN	1	89.5	94.3	.93	1.81
10609	ETFN	1	91.1	96.1	1.17	2.34
10608	ETFN	1	75.4	70.0	.13	.16

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.L.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.L.
10607	8TFN	1	87.4	92.4	.70	1.40
10606	8TFN	1	82.4	87.4	.35	.70
10605	8TFN	1	88.5	93.6	.82	1.64
10604	8TFN	1	89.0	94.1	.88	1.75
10603	8TFN	1	88.5	93.6	.82	1.64
10602	8TFN	1	87.4	92.4	.70	1.40
10601	8TFN	1	92.4	97.4	1.40	2.81
10600	8TFN	1	89.5	94.5	.93	1.87
10544	8T3	1	87.4	92.4	.70	1.40
10543	8T3	1	93.4	98.4	1.60	3.19
10542	8T3	1	79.5	84.5	.23	.47
10541	8T3	1	94.9	100.0	1.95	3.90
10540	8T3	1	84.5	89.5	.47	.94
10539	8T3	1	88.5	93.6	.82	1.64
10538	8T3	1	86.8	91.8	.64	1.29
10537	8T3	1	91.1	96.1	1.17	2.34
10536	8T3	1	89.5	94.5	.93	1.87
10535	8T3	1	90.7	95.8	1.11	2.22
10534	8T3	1	90.2	94.7	1.03	1.91
10533	8T3	1	89.9	95.0	.99	1.99
10532	8T3	1	88.5	93.6	.82	1.64
10531	8T3	1	92.4	97.4	1.40	2.81
10530	8T3	1	87.4	92.4	.70	1.40
10529	8T3	1	92.4	97.4	1.40	2.81
10528	8T3	1	92.4	97.4	1.40	2.81
10527	8T3	1	94.3	99.3	1.81	3.63
10526	8T3	1	89.5	94.5	.93	1.87
10525	8T3	1	87.4	92.4	.70	1.40
10524	8T3	1	84.3	87.8	.46	.74
10523	8T3	1	87.4	92.4	.70	1.40
10522	8T3	1	91.6	96.7	1.25	2.51
10521	8T3	1	82.4	87.4	.35	.70
10520	8T3	1	90.4	95.4	1.05	2.11
10519	8T3	1	89.5	94.5	.93	1.87
10518	8T3	1	93.5	98.6	1.63	3.25
10517	8T3	1	88.5	93.6	.82	1.64

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 DBA
8-HR PERMISSIBLE LEVEL = 90.0 DBA
EXCHANGE RATE = 5 DBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL M.L.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE M.L.
10516	BT3	1	89.9	95.0	.99	1.99
10515	BT3	1	89.5	94.5	.93	1.87
10514	BT3	1	87.7	92.7	.73	1.46
10513	BT3	1	90.4	95.4	1.05	2.11
10512	BT3	1	90.4	95.4	1.05	2.11
10511	BT3	1	87.7	92.7	.73	1.46
10510	BT3	1	89.5	94.5	.93	1.87
10509	BT3	1	86.1	91.1	.58	1.17
10508	BT3	1	90.4	95.4	1.05	2.11
10507	BT3	1	89.6	91.3	.95	1.19
10506	BT3	1	79.5	84.5	.23	.47
10505	BT3	1	92.4	94.3	1.41	1.8
10504	BT3	1	93.4	95.0	1.60	2.24
10503	BT3	1	93.4	95.0	1.60	2.24
10502	BT3	1	86.1	91.1	.58	1.17
10501	BT3	1	92.4	97.4	1.40	2.81
10500	BT3	1	89.5	94.5	.93	1.87
10423	BT2	1	89.0	94.1	.88	1.75
10422	BT2	1	91.5	95.8	1.23	1.70
10421	BT2	1	86.1	91.1	.58	1.17
10420	BT2	1	88.5	93.8	.82	1.64
10419	BT2	1	89.5	94.5	.93	1.87
10418	BT2	1	88.8	91.8	.84	1.29
10417	BT2	1	88.5	93.8	.82	1.64
10416	BT2	1	91.8	96.8	1.28	2.57
10415	BT2	1	94.0	99.1	1.75	3.51
10414	BT2	1	94.0	99.1	1.75	3.51
10413	BT2	1	85.4	90.4	.53	1.05
10412	BT2	1	84.5	89.5	.47	.94
10411	BT2	1	92.4	97.4	1.40	2.81
10410	BT2	1	92.2	97.2	1.35	2.07
10409	BT2	1	95.4	100.4	2.10	4.21
10408	BT2	1	79.5	84.5	.23	.47
10407	BT2	1	92.4	97.4	1.40	2.81
10406	BT2	1	87.4	92.4	.70	1.40
10405	BT2	1	92.4	97.4	1.41	2.81

PERSONNEL NOISE EXPOSURE AND IMPACT

THRESHOLD LEVEL = 80.0 dBA
8-HR PERMISSIBLE LEVEL = 90.0 dBA
EXCHANGE RATE = 5 dBA

ALL SHIPS

GRADE CODE	GRADE DESCRIPTION	NO. OF PERS.	SOUND LEVEL MEAN	SOUND LEVEL R.M.S.	DAILY NOISE DOSE MEAN	DAILY NOISE DOSE R.M.S.
10404	GT2	1	87.9	95.0	.99	1.99
10403	GT2	1	87.4	92.4	.70	1.40
10402	GT2	1	92.4	97.4	1.40	2.81
10401	GT2	1	89.5	94.5	.93	1.87
10400	GT2	1	87.4	92.4	.70	1.40
10311	GT1	1	89.5	94.5	.93	1.87
10310	GT1	1	88.5	93.0	.82	1.64
10309	GT1	1	91.8	96.8	1.28	2.57
10308	GT1	1	90.8	95.8	1.11	2.08
10307	GT1	1	90.7	95.6	1.11	2.22
10306	GT1	1	92.4	97.4	1.40	2.81
10305	GT1	1	72.3	73.3	.07	.13
10304	GT1	1	83.9	88.7	.43	.84
10303	GT1	1	86.9	91.7	.65	1.30
10302	GT1	1	87.4	92.4	.70	1.40
10301	GT1	1	88.5	93.5	.82	1.64
10300	GT1	1	87.4	92.4	.70	1.40
10206	GTC	1	89.0	94.1	.88	1.75
10205	GTC	1	84.5	89.5	.47	.94
10204	GTC	1	79.5	84.5	.23	.47
10203	GTC	1	89.5	94.5	.93	1.87
10202	GTC	1	90.9	95.9	1.14	2.28
10201	GTC	1	90.7	95.8	1.11	2.22
10200	GTC	1	71.4	74.9	.06	.12
10100	GTCM	1	88.5	93.0	.82	1.64

APPENDIX N

Dosimeter and Calculated Equivalent Sound Level Data Comparisons

Appendix N-1

Differences between calculated ESL data and dosimeter data on an individual basis, with no averaging of measured noise levels.

Ship No.	Rate	Leq Calc.	Leq Dos.	Difference Dos.-Calc.		
FF-1094	BTFR	91.0	97.9	6.9		
USS Pharris	BTFR	88.5	85.1	-3.4		
	BT3	88.8	91.6	2.8		
	BTFN	87.9	96.3	8.4		
	BT2	85.1	87.1	2.0		
					Mean	3.3
					S.D.	4.6
FF-1085	BT3	84.3	85.5	1.2		
USS Beary	BT3	79.7	84.1	4.4		
	BT1	87.9	86.1	-1.8		
	BTFA	72.0	84.3	12.3		
	BT3	82.9	80.8	-2.1		
	BT3	90.6	89.7	-0.9		
					Mean	2.2
					S.D.	5.5
FF-1092	MMFN	83.0	94.8	11.8		
USS Thomas C. Hart	MMFR	87.3	92.4	5.1		
	BTFN	86.0	98.3	12.3		
	BT3	84.9	82.8	-2.1		
	MMFA	93.5	88.2	-5.0		
	MMFN	73.5	91.1	17.6		
					Mean	6.6
					S.D.	8.9
FF-1081	MM3	82.3	88.1	5.8		
USS Aylwin	MM3	85.6	87.6	2.0		
	MM3	88.5	88.4	-0.1		
	BT3	85.6	92.0	6.4		
	BT3	89.4	90.4	1.0		
	BT3	86.0	91.1	5.1		
					Mean	3.4
					S.D.	2.7

Appendix N-1 (cont)

Ship No.	Rate	Leq Calc.	Leq Dos.	Difference Dos.-Calc.	
FF-1097	MMFA	87.6	81.3	-6.3	
USS Moinester	BT3	92.2	90.0	-2.2	
	BT3	81.1	93.0	11.9	
	FN	84.8	95.0	10.2	
				Mean	3.4
				S.D.	9.0
FF-1075	BT2	68.0	87.2	19.2	
USS Trippe	BT3	68.0	86.6	18.6	
	BTFA	90.5	84.8	-5.7	
	BTFN	90.9	91.3	10.4	
	BT2	87.5	78.0	-9.5	
	BTFN	68.0	87.5	16.8	
	BT3	88.0	87.5	0.5	
	MM3	90.9	94.7	3.8	
	MMFN	89.6	90.6	1.0	
	MMFN	84.0	84.0	0.0	
				Mean	4.5
				S.D.	10.2
				Overall Mean	4.0
				Overall Standard Deviation	7.3

Appendix N-2

Differences between calculated ESL data and dosimeter data on an individual basis, with sub area averaging of measured noise levels.

Ship No.	Rate	Leq Calc.	Leq Dos.	Difference Dos.-Calc.		
FF-1094	BTFR	90.1	97.9	7.8		
USS Pharris	BTFR	90.2	85.1	-5.1		
	BT3	89.9	91.6	1.7		
	BTFN	89.9	96.3	6.4		
	BT2	90.2	87.1	-3.1		
					Mean	1.5
					S.D.	5.7
FF-1085	BT3	94.9	85.5	-9.4		
USS Beary	BT3	97.6	84.1	-13.5		
	BT1	90.6	86.1	-4.5		
	BTFA	90.8	84.3	-6.5		
	BT3	85.2	80.8	-4.4		
	BT3	92.2	89.7	-2.5		
					Mean	-6.8
					S.D.	4.0
FF-1092	MMFN	83.0	94.8	11.8		
USS Thomas C. Hart	MMFR	87.3	92.4	5.1		
	BTFN	85.2	98.3	13.1		
	BT3	85.9	82.8	-3.1		
	MMFA	93.4	88.2	-5.2		
	MMFN	89.1	91.1	2.0		
					Mean	3.9
					S.D.	7.5
FF-1081	MM3	87.3	88.1	0.8		
USS Aylwin	MM3	81.7	87.6	5.9		
	MM3	86.7	88.4	1.7		
	BT3	90.4	92.0	1.6		
	BT3	90.3	90.4	0.1		
	BT3	92.1	91.1	-1.0		
					Mean	1.5
					S.D.	2.4

Appendix N-2 (cont)

Ship No.	Rate	Leq Calc.	Leq Dos.	Difference Dos.-Calc.	
FF-1097	MMFA	85.6	81.3	-4.3	
USS Moinester	BT3	91.5	90.0	-1.5	
	BT3	91.5	93.0	1.5	
	FN	85.0	95.0	10.0	
				Mean	1.4
				S.D.	6.2
FF-1075	BT2	85.5	87.2	1.7	
USS Trippe	BT3	90.5	86.6	-3.9	
	BTFA	90.5	84.8	-5.7	
	BTFN	88.1	91.3	3.2	
	BT2	87.5	78.0	-9.5	
	BTFN	87.5	84.8	-2.7	
	BT3	85.1	87.5	2.4	
	MM3	89.7	94.7	5.0	
	MMFN	88.3	90.6	2.3	
	MMFN	87.1	84.0	-3.1	
				Mean	-1.0
				S.D.	4.6
				Overall Mean	-0.1
				Overall Standard Deviation	5.9

Appendix N-3

Differences between calculated ESL data and dosimeter data on an individual basis, with general area averaging of measured noise levels.

Ship No.	Rate	Leq Calc.	Leq Dos.	Difference Dos.-Calc.		
FF-1094	BTFR	90.1	97.9	7.8		
USS Pharris	BTFR	90.1	85.1	-5.0		
	BT3	90.1	91.6	1.5		
	BTFN	90.1	96.3	6.2		
	BT2	90.1	87.1	-3.0		
					Mean	1.5
					S.D.	5.6
FF-1085	BT3	95.0	85.5	-9.5		
USS Beary	BT3	97.7	84.1	-13.6		
	BT1	92.2	86.1	-6.1		
	BTFA	90.8	84.3	-6.5		
	BT3	86.4	80.8	-5.6		
	BT3	92.9	89.7	-3.2		
					Mean	-7.4
					S.D.	3.6
FF-1092	MMFN	83.0	94.8	11.8		
USS Thomas C. Hart	MMFR	88.9	92.4	3.5		
	BTFN	85.1	98.3	13.2		
	BT3	86.0	82.8	-3.2		
	MMFA	95.1	88.2	-6.9		
	MMFN	89.7	91.1	1.4		
					Mean	3.3
					S.D.	8.0
FF-1081	MM3	87.3	88.1	0.8		
USS Aylwin	MM3	83.9	87.6	3.7		
	MM3	88.9	88.4	-0.5		
	BT3	91.7	92.0	0.3		
	BT3	89.1	90.4	1.3		
	BT3	90.9	91.1	0.2		
					Mean	1.0
					S.D.	1.5

Appendix N-3 (cont)

Ship No.	Rate	Leq Calc.	Leq Dos.	Difference Dos.-Calc.	
FF-1097	MMFA	85.8	81.3	-4.5	
USS Moinester	BT3	91.8	90.0	-1.8	
	BT3	91.8	93.0	1.2	
	FN	86.9	95.0	8.1	
				Mean	0.8
				S.D.	5.4
FF-1075	BT2	85.5	87.2	1.7	
USS Trippe	BT3	90.5	86.6	-3.9	
	BTFA	90.5	84.8	-5.7	
	BTFN	90.5	91.3	0.8	
	BT2	87.5	78.0	-9.5	
	BTFN	87.5	84.8	-2.7	
	BT3	87.5	87.5	0.0	
	MM3	91.2	94.7	3.5	
	MMFN	89.9	90.6	0.7	
	MMFN	85.6	84.0	-1.6	
				Mean	-1.9
				S.D.	4.1
				Overall Mean	-0.7
				Overall Standard Deviation	5.8

Appendix N-4

Differences between calculated ESL data and dosimeter data on a grade average and individual ship basis with no averaging of measured noise levels.

Ship No.	Rate	Leq Calc.	Leq Dos.	Difference Dos.-Calc.		
FF-1094	BTFR	89.3	9.15	2.2		
USS Pharris	BT3	87.1	91.6	4.5		
	BTFN	88.6	96.3	7.7		
	BT2	83.4	87.1	3.7		
					Mean	4.5
					S.D.	2.3
FF-1085	BT3	84.9	85.0	0.1		
USS Beary	BT1	87.0	86.1	-0.9		
	BTFA	****	84.3	***		
					Mean	-0.4
					S.D.	0.7
FF-1092	MMFN	82.1	93.0	10.9		
USS Thomas C. Hart	MMFR	87.3	92.4	5.1		
	BTFN	78.0	98.3	20.0		
	BT3	84.2	82.8	-5.7		
	MMFA	93.5	88.2	-5.3		
					Mean	5.0
					S.D.	11.0
FF-1081	MM3	85.4	88.0	2.6		
USS Aylwin	BT3	87.0	91.2	4.2		
					Mean	3.4
					S.D.	1.1
FF-1097	MMFA	85.4	81.3	-4.1		
USS Moinester	BT3	90.5	91.5	1.0		
	FN	84.5	95.0	10.5		
					Mean	2.5
					S.D.	7.4
FF-1075	BT2	87.5	82.6	-4.9		
USS Trippe	BT3	88.0	87.0	-1.0		
	BTFA	90.5	84.8	-5.7		
	BTFN	90.9	88.0	-2.9		
	MM3	90.9	94.7	3.8		
	MMFN	87.8	87.3	-0.5		
					Mean	-1.9
					S.D.	3.5
					Overall Mean	2.1
					Overall Standard Deviation	6.3

Appendix N-5

Differences between calculated ESL data and dosimeter data on a grade average and individual ship basis with sub area averaging of measured noise levels.

Ship No.	Rate	Leq Calc.	Leq Dos.	Difference Dos.-Calc.	
FF-1094	BTFR	90.2	91.5	1.3	
USS Pharris	BT3	88.8	91.6	2.0	
	BTFN	89.8	96.3	6.5	
	BT2	90.0	87.1	-2.9	
				Mean	1.7
				S.D.	3.8
FF-1085	BT3	91.6	85.0	-6.6	
USS Beary	BT1	88.9	86.1	-2.8	
	BTFA	90.8	84.3	-6.5	
				Mean	-5.3
				S.D.	2.2
FF-1092	MMFN	87.5	93.0	5.5	
USS Thomas C. Hart	MMFR	87.3	92.4	5.1	
	BTFN	80.0	98.3	18.3	
	BT3	85.2	82.8	-2.4	
	MMFA	93.4	88.2	-5.2	
				Mean	4.3
				S.D.	9.1
FF-1081	MM3	85.3	88.0	2.7	
USS Aylwin	BT3	90.9	91.2	0.3	
				Mean	1.5
				S.D.	1.7
FF-1097	MMFA	83.1	81.3	-1.8	
USS Moinester	BT3	88.8	91.5	2.7	
	FN	84.7	95.0	10.3	
				Mean	3.7
				S.D.	6.1
FF-1075	BT2	87.8	82.6	-5.2	
USS Trippe	BT3	87.8	87.0	-0.8	
	BTFA	90.5	84.8	-5.7	
	BTFN	87.8	88.0	0.2	
	MM3	89.7	94.7	5.0	
	MMFN	88.4	87.3	-1.1	
				Mean	-1.3
				S.D.	3.9
				Overall Mean	.8
				Overall Standard Deviation	5.9

Appendix N-6

Differences between calculated ESL data and dosimeter data on a grade average and individual ship basis with general area averaging of measured noise levels.

Ship No.	Rate	Leq Calc.	Leq Dos.	Difference Dos.-Calc.	
FF-1094	BTFR	90.1	91.5	1.4	
USS Pharris	BT3	88.8	91.6	2.8	
	BTFN	89.8	96.3	6.5	
	BT2	90.0	87.1	-2.9	
				Mean	2.0
				S.D.	3.9
FF-1085	BT3	92.3	85.0	-7.3	
USS Beary	BT1	89.7	86.1	-3.6	
	BTFA	90.8	84.3	-6.5	
				Mean	-5.8
				S.D.	2.0
FF-1092	MMFN	88.1	93.0	4.9	
USS Thomas C. Hart	MMFR	88.9	92.4	3.5	
	BTFN	80.0	98.3	18.3	
	BT3	85.2	82.8	-2.4	
	MMFA	95.1	88.2	-6.9	
				Mean	3.5
				S.D.	9.5
FF-1081	MM3	86.8	88.0	1.2	
USS Aylwin	BT3	90.6	91.2	0.6	
				Mean	0.9
				S.D.	0.4
FF-1097	MMFA	83.3	81.3	-2.0	
USS Moinester	BT3	89.1	91.5	2.4	
	FN	86.0	95.0	9.0	
				Mean	3.1
				S.D.	5.5
FF-1075	BT2	87.8	82.6	-5.2	
USS Trippe	BT3	89.0	87.0	-2.0	
	BTFA	90.5	84.8	-5.7	
	BTFN	89.0	88.0	-1.0	
	MM3	91.2	94.7	3.5	
	MMFN	88.4	87.3	-1.1	
				Mean	-1.9
				S.D.	3.4
				Overall Mean	0.3
				Overall Standard Deviation	5.9

Appendix N-7

Differences between calculated ESL data and dosimeter data on a grade average (over all ships) basis with no area averaging of measured noise levels.

Ship No.	Rate	Leq Calc.	Leq Dos.	Difference Dos.-Calc.
All Ships	BT1	79.5	86.1	6.6
	BT2	76.6	87.3	10.7
	BT3	82.0	88.1	6.1
	BTFA	85.5	84.6	-0.9
	BTFN	85.5	92.7	7.2
	BTFR	86.7	91.5	4.8
	MM3	83.5	89.7	6.2
	MMFA	85.6	84.7	-0.9
	MMFN	83.7	90.1	6.4
	MMFR	88.7	92.4	3.7
	FN	81.8	95.0	13.2

Overall Mean 5.7
Overall Standard Deviation 4.2

Appendix N-8

Differences between calculated ESL data and dosimeter data on a grade average (over all ships) basis with sub area averaging of measured noise levels.

Ship No.	Rate	Leq Calc.	Leq Dos.	Difference Dos.-Calc.
All Ships	BT1	87.4	86.1	-1.3
	BT2	89.8	87.3	-2.5
	BT3	89.0	88.1	-0.9
	BTFA	88.2	84.6	-3.6
	BTFN	87.8	92.7	4.9
	BTFR	88.3	91.5	3.2
	MM3	86.2	89.7	3.5
	MMFA	85.2	84.7	-0.5
	MMFN	85.5	90.1	4.6
	MMFR	88.7	92.4	3.7
	FN	82.9	95.0	12.1

Overall Mean 2.1
Overall Standard Deviation 4.5

Appendix N-9

Differences between calculated ESL data and dosimeter data on a grade average (over all ships) basis with general area averaging of measured noise levels.

Ship No.	Rate	Leq Calc.	Leq Dos.	Difference Dos.-Calc.
All Ships	BT1	87.6	86.1	-1.5
	BT2	89.5	87.3	-2.2
	BT3	89.3	88.1	-1.2
	BTFA	87.7	84.6	-3.1
	BTFN	88.3	92.7	4.4
	BTFR	87.5	91.5	4.0
	MM3	86.9	89.7	2.8
	MMFA	86.1	84.7	-1.4
	MMFN	86.0	90.1	4.1
	MMFR	89.2	92.4	3.2
	FN	83.3	95.0	11.7

Overall Mean 1.9
Overall Standard Deviation 4.3

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